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# HINTS TO TRAVELLERS

## SCIENTIFIC AND GENERAL

EDITED FOR THE

**Council of the Royal Geographical Society**

BY

JOHN COLES, F.R.G.S., F.R.A.S.

*Late Instructor in Surveying and Practical Astronomy to the Royal Geographical Society.*



EIGHTH EDITION

*REVISED AND ENLARGED*

VOL. I.

SURVEYING AND PRACTICAL ASTRONOMY

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# PREFACE TO THE EIGHTH EDITION.

WITH a view to extending the usefulness of 'Hints to Travellers,' the Council of the Royal Geographical Society resolved to publish the present enlarged edition in two volumes.

In Vol. I, "Surveying and Practical Astronomy," much that appeared in the seventh edition has been retained, but important additions have been made. These include a new set of examples of astronomical computations, considerable expansion of the section on surveying, including photographic surveying, a graphic method of predicting the occultation of stars by the moon, and an entire set of tables, by the use of which and the "Nautical Almanac," the traveller will be able to compute the results of his observations. For permission to insert these tables, the Society is indebted to the firm of J. D. Potter, the proprietors of Raper's well-known "Practice of Navigation."

In Vol. II, "Meteorology, Photography, Geology, Natural History, Anthropology, Medical Hints, etc.," the sections on Meteorology and Medical and Surgical Hints have been entirely rewritten and greatly enlarged, while the other sections have been revised by the authors whose names appear at the head of the chapters containing their contributions.

Hints on Outfit, etc., will be published in a separate pamphlet.

I am indebted to Colonel St. George C. Gore, R.E., Surveyor-General of India, for kind advice and assistance; and my thanks are due to Mr. E. A. Reeves, Map Curator, R.G.S., for looking through the proofs.

JOHN COLES.

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# HINTS TO TRAVELLERS.

*VOL. I.*

## SURVEYING AND ASTRONOMICAL OBSERVATIONS.

*By* JOHN COLES, F.R.A.S., *late Instructor in Surveying and Practical Astronomy to the Royal Geographical Society; and others.*

## PART I.

## INSTRUMENTS USED FOR ASTRONOMICAL OBSERVATIONS AND SURVEYING.

*Preliminary Remarks.*—The intending traveller who proposes to undertake the survey of an unexplored country, should make himself acquainted with the use and adjustments of every instrument he purposes to employ; he should have a knowledge of plane trigonometry, and those computations of practical astronomy which are necessary to enable him to fix his position in latitude and longitude; and although from his note-book he may furnish cartographers with valuable material, yet, without such previous training, it is scarcely possible for him to map the country through which he travels, nor will he be able to take full advantage of these 'Hints,' as the greater part of the matters dealt with will be beyond his comprehension. The attainment of this necessary amount of knowledge is by no means difficult, and a few weeks of study, under proper instruction, ought, in most cases, to enable him, by the aid of the following pages, to do useful geographical work. It is with this end in view that this volume of 'Hints to Travellers' has been written in the simplest form.

## 1. Scientific Outfit.*

*Sextant for regular work*—

A sextant of 6-inch radius, light in weight, by a first-rate maker, divided on platinum or silver, to ten minutes, to read with vernier to ten seconds. It should have a moveable ground-glass screen in front of the reading-off lens, to tone down a glaring light. The handle must be large and convenient; the box capacious enough to hold the instrument with its index clamped to any part of the arc, and the receptacle for the inverting telescope long enough to allow of it being put into the box when set at focus.

*Sextant for detached expeditions, and for taking altitudes when the other sextant is in use for lunars*—

A sextant of 3-inch radius, graduated to 20′, to read with vernier to 20″, in a leather case, fitted to slip on to a leather belt, to be worn round the waist, when required.

*Mercurial Artificial Horizon*—

One of the common form with folding roof, by a good maker, or the form devised by the late Captain George, R.N. *Reserve:* an iron bottle of pure mercury.

*Watches*—

A keyless silver half-chronometer watch, not too heavy, with an open face and a second hand. The hands should be of black steel, long enough to cover the divisions. The divisions should be very clear and distinct. See that the second hand falls everywhere truly upon the divisions. *Reserve:* at least two more good watches; these should be rolled up separately, each in a loosely-wrapped parcel of *dry* clothes, and they will never come to harm; they should be labelled, and rarely opened. The immediate envelope should be

* It will be understood that the necessity for taking all the articles herein enumerated will depend upon the nature of the journey.

free from fluff or dirt. Covers of chamois leather should be washed before use Three spare watch-keys; one might be tied to the sextant-case, one wrapped up with each watch. (*See* p. 43 for further particulars.)

*Mem.*:—Chronometers are designedly omitted from this list, on account of the proved difficulty of transporting them without injury, and the frequent disappointments they have caused, even to very careful travellers.

*Compasses*—

A prismatic compass, graduated on silver or aluminium, from 0° to 360°.

Two pocket compasses, from 1½ to 2 inches in diameter. The graduations on their cards should run from 0° to 360°, and not twice over from 0° to 180°. A line for True North, temporarily marked on the cards, in the position most appropriate to the magnetic variation in the country about to be visited, may be found convenient. These compasses should be light in weight, have plenty of depth, and be furnished with catches, to relieve the needle from its pivot when not used. The needles should work smoothly and quickly: such as make long, slow oscillations are to be avoided. Cards, half black and half white, are recommended. (*See* pp. 10, 11 for further particulars.)

*Steel Tape*—

A 100-foot steel tape will be found very useful in measuring a base, or when making plans. A fishing-line on reel for roughly measuring a base, with knots at convenient intervals, will, under certain circumstances, be useful.

*Lantern*—

All lanterns should be made of copper or brass, as, if made of iron, they will affect the compass reading when taking the bearing of a heavenly body at night, and should be constructed for long journeys and hot climates, to be used with oil, and furnished with a large wick. A candle lantern is convenient where

candles can be carried. See that there is abundant supply of air-holes in the *sides;* these are essential when the lantern is set upon the ground. Also that all the internal fittings can be removed and cleaned, and that they are solidly made, not merely soldered. It should be furnished with a reflector, to throw a clear light forwards and *downwards.* A moveable shade of light green glass will be found to be a great improvement, as it prevents the light from dazzling the eyes, and enables the observer to take the reading on the sextant with greater ease. A good lantern is *most important.* For general purposes, the Italian Alpine Club lantern is one of the best forms. A small ball of spare wick, oil of the best quality obtainable, and wax tapers, for use on detached expeditions, should also be taken.

*Thermometers—*

Several sling thermometers.

A pair of wet and dry bulb thermometers.

A pair of maximum and minimum thermometers, fitted in one case.

Three short and stout boiling-point thermometers, with apparatus for boiling them. (*See* p. 13 for further particulars.)

Two ordinary thermometers, which should be graduated from 20° or more below the freezing- to above the boiling-point. For very cold climates, spirit thermometers should be taken.

Standard thermometers, at a charge of 1*l.* each, graduated at the National Physical Laboratory, Richmond, Surrey, may be obtained thence, on the application of any Fellow of the Royal Society, or Member of the British Association.

*Aneroids—*

Aneroids of ordinary construction should be of large pocket size (2½ inches across). They can be obtained graduated up to 20,000 feet at most instrument makers. At any such height, however, their records can never be depended on. Aneroids are excellent for most differential observations, but *unreliable for absolute* ones; they should be observed, as much as possible, in conjunction with

the boiling-point thermometers. Two are required, because simultaneous observations are important. Recollect that such observations, taken even at distances of two or three hundred miles apart, are of value, as the areas are usually very large over which the barometer has nearly the same height at the same moment of time at equal elevations.

*"Watkin Mountain" Aneroid*—

This instrument can be put into action when required, and, when thrown out of action, is not influenced by the variations in atmospheric pressure. A series of experiments with it has been carried out by Mr. Edward Whymper, the results of which have been published in *The Geographical Journal*, January, 1899. It has also been used by other travellers, who have reported satisfactorily on its performance. As, however, this is a new instrument, travellers will do well not to place implicit confidence in it, until it has been further tested by explorers.

For barometers, *see* p. 7, and Vol. II., p. 25 *et seq*.

*Mapping Instruments*—

A small leather pocket-case of drawing instruments, containing, among other things, hair-compasses, drawing-pen, and a rectangular protractor, with scales of chords, sines, tangents, &c., engraved on it.

Marquois's scales, for ruling parallel lines at definite intervals.

Protractors: one circular, of metal, and one of celluloid, of 6 inches in diameter; one of vulcanite, 6 inches, all graduated, like the prismatic compass, from 0° to 360°.

A metal ruler of 1 foot or more in length, graduated to tenths of an inch, with diagonal scale: 2 dozen artist's pins. Medium size measuring tape, say 50 feet; pocket ditto, 2 yards.

*Stationery, &c.*—

An artist's board, not less than 8 inches by 13, made of light, well-seasoned pine, and what cabinet-makers call "framed," to rule and draw upon.

Plenty of good ordinary paper. Reporters' note-books ruled (not "metallic," for prepared paper is not strong enough, and the leaves of such books are very liable to become torn out and lost; they are also damaged by wet). They should be all of one size, say 7 inches by 4½, or larger, and numbered. A leather pouch, secured to the waist-belt, having a flap buttoning easily over, to hold the note-book in use.

Two (or more) MS. books of strong ruled paper, foolscap size, each with a leather binding; the pages should be numbered, and journal observations, agreements, and everything else of value, written in them.

Some sheets of blotting-paper cut up, and put here and there in the books.

Transparent cloth and paper for tracing.

Plenty of brass pens and holders; also fine drawing-pens (steel crow-quills—Brandauer's Oriental pens are very good) and holder. A. W. Faber's H.H.H.H.H.H., F, and B pencils.

Penknives. India-rubber cut up into pieces.

Ink-powders of a kind that do not require vinegar. Red ink.

Paints for maps, viz., Indian ink, sepia, burnt-sienna, lake, cobalt, gamboge, oxgall, in a small tin case.

A dozen sable paint-brushes of different sizes.

Materials for "squeezes," if travelling where inscriptions may have to be copied (*see* Vol. II., p. 131).

*Books, Maps, &c.*—

Raper's Practice of Navigation; or, in default of this, either Inman's Navigation and Tables (bound together), or Norie's Navigation.

Chambers' Mathematical Tables are very comprehensive and useful.

Molesworth's Pocket-Book of Engineering Formulæ (London: E. & F. N. Spon).

Shadwell's Cards of Formulæ (Potter, 31, Poultry, London); Bethune's Tables for Travellers (Blackwood and Sons).

With the help of either of these two latter publications, the traveller, who has a fair knowledge of mathematics, will thoroughly understand what he is about, and may, on emergency, dispense with some

of the usual cumbrous tables, confining himself to ordinary tables of logarithms. But all travellers should be furnished with a complete set of tables, because they afford at a single reference, what otherwise requires additional trouble to obtain.

'Nautical Almanac' for current and future years, strongly stitched in cloth.

Some small Almanacs, such as 'Whitaker's,' contain tables of the position of sun and planets, and of stars to be occulted. One of these is useful to afford what is necessary to take on a detached expedition, the required pages being cut out of it.

More extended barometric tables than are given in this volume may be procured at the instrument makers, or cut out from Guyot's elaborate Meteorological tables, published by the Smithsonian Institution, New York.

Blank maps, ruled for the latitudes and longitudes of the proposed route.

The best maps obtainable of the country you propose to visit.

Admiralty Manual of Scientific Enquiry.

*Mem.*:—Chauvenet's Astronomy (New York, 2 vols.) is one of the most complete and thorough of the mathematical works on astronomical observations; it is, however, a book for previous study, rather than for reference in the field.

*Instruments Requisite for Detailed Surveys.*

*Theodolites*—(*See* p. 23 *et seq.*)

*Mercurial Barometers*—(Vol. II., p. 25 *et seq.*)

Barometers of Fortin's pattern were successfully carried to great heights by Mr. Whymper, in South America; but the risk of breakage, at all times very great, is proportionally greater on longer journeys. Care should be taken to see that all barometers read low enough to be used at great elevations. The form of barometer devised by Prof. Norman Collie is very portable.

*Telescope* for observation of occultations and eclipses of Jupiter's satellites (*see* pp. 169 and 202). One with a two-inch object glass, clear

aperture, by a good maker. It should be mounted on a split tripod, and furnished with a Kelner eye-piece, of not less magnifying-power than 40, and should be fitted with an arrangement by which it can, when removed from the stand, be screwed firmly to a tree or other support. The telescope should be tried on Jupiter, and found to give a satisfactory view of the satellites, before it is taken.

*Plane table.*—Two plane tables, and spare horse-hair for sight vanes. They should be in strong canvas bags with leather-covered corners, and furnished with straps, so that they can be carried like a knapsack. For information as to use and form of construction, see pp. 40, 42, and 97 to 109.

*Pedometer.*—Apt to get out of order. If employed, at least three persons should each carry one.

*Clinometer.*

*Pocket level* (Abney's), with a mirror to show where the bubble is when it is held to the eye. It also serves as a clinometer for the measurement of slopes.

*Rain gauge,* see Vol. II., pp. 23 to 26.

### *Examination of Instruments.*

Let every instrument be tested, and its errors determined and tabulated at the National Physical Laboratory, Richmond, Surrey.* This is done for moderate fees. The following are some of the present charges:—Watches, A class, £1 1*s.*, B class, 10*s.* 6*d.*; ordinary thermometers, 1*s.*; boiling-point thermometers, 2*s.* 6*d.*; marine and portable barometers, 10*s.* 6*d.*; prismatic compasses, A class, 6*s.*, B class, 4*s.* 6*d.*; theodolites,

* This should be attended to by the traveller, especially in the case of thermometers which have been previously examined at Kew Observatory, as it has been found that their errors change considerably; for instance, a boiling-point thermometer which was tested in 1884 was found, in five years, to have increased its error at some readings by no less than ·2 of a degree, and in no part of the scale by less than ·1 of a degree.

5*s.*; superior sextants, 5*s.* Unifilars, dip circles, and other magnetic instruments are also verified. The carriage of the instruments to and from the Observatory must be paid. Address—"Superintendent of the National Physical Laboratory, Richmond, Surrey." The establishment lies ten minutes' walk from the Richmond railway station. Any persons ordering instruments from opticians may direct them to be previously forwarded there for verification. They can be sent direct, or through the receiving establishment at the Meteorological Office, 63, Victoria Street, Westminster, S.W.

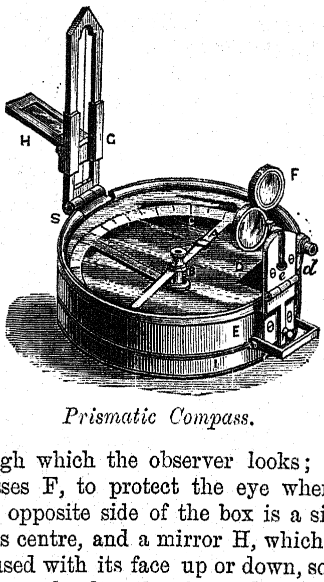
### *Packing.*

It is difficult to give general rules, because the modes of transport vary materially in different countries. Inquiry should be made by the intending traveller at the Royal Geographical Society's rooms as to the kind of packing best suited for his special purposes and field of exploration. The corners of all the instrument cases should be brass-bound; the fittings should be screwed, and not glued; and the boxes should be large enough to admit of the instruments being taken out and replaced with perfect ease. Instrument makers are apt to attend over-much to compactness, making as much as possible go into a small box, which can easily be put on a shelf; but this is not what a traveller wants, bulk being rarely so great a difficulty to him as weight. Above all, it is most important that he should be able to get at his instruments easily, even in the dark. He should notice particularly the manner in which the instrument is placed in its box, before taking it out, *and in the case of a theodolite, observe the positions of the verniers, and the object end of the telescope;* attention to this will prevent much loss of time and possible injury to the instrument. Moreover, a large, light box suffers much less from an accidental concussion than a small and heavy one. Thermometers travel best when slipped into india-rubber tubes in a brass casing. A coil of such tubing will serve as a floor, to protect a case of delicate instruments from the effects of a jar. Horse-hair is of use to replace old packing, but it has first to be prepared by steeping in boiling water, twisting into a rope, and, after it is firmly set, chopping it into pieces. The hairs retain their curvature and act as springs. Instruments travel excellently when packed in *loose, tumbled* cloths.

## 2. Instruments, and their Adjustments.

### *Compasses.*

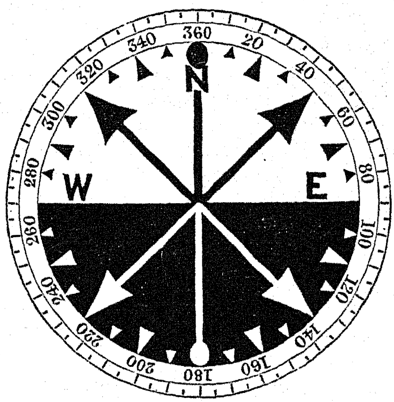
*Prismatic Compass*:—This instrument consists of a magnetic needle, A, balanced on a pivot, B, carrying an aluminium ring, C, divided into 360°; it is graduated from the *south* pole of the needle,—by west, north, and east to south again, from 0° to 360°; the 0° is not shown on the ring, since it coincides with 360°. A prism, D, is fixed on one side of the box, E, mounted on a hinge-joint, *d*; it can be turned down when not in use, and is attached to a plate, *e*, which slides up and down to suit the vision of the observer. In the plate




*Prismatic Compass.*

there is a slit through which the observer looks; it has also an arm with two dark glasses F, to protect the eye when taking a bearing of the sun. On the opposite side of the box is a sight-vane G, having a fine thread down its centre, and a mirror H, which slides on and off as required; it can be used with its face up or down, so as to reflect images of objects which cannot be directly observed. The sight-vane is also fitted with a hinge-joint, and when shut down, presses on a lever, which lifts the needle off the pivot. In front of the sight-vane there is a small

stud S, by pressing which with the finger the ring is brought to rest; it also serves to check the vibration of the needle. The box E has a cover I, which fits either the top or bottom, in which latter position it is shown in the drawing, and with it the instrument can be held when taking an observation. The prismatic compass is frequently fitted to screw on to a light tripod, with a ball and socket adjustment, and can then be used with greater accuracy either for taking bearings, or as an angular measuring instrument.




*Pocket Compass.*

A prismatic compass is not suited for taking bearings, except through the prism, on account of the reversal of the figures, and their arrangement from the south point; it will therefore be convenient, for taking rough bearings, for the traveller to provide himself with a pocket compass, having a card of the size and pattern, shown above; it should be made of aluminium, which is both light and strong. The compass box should be fitted with a lever to throw the magnetic needle off its centre when the compass is not in use, and the glass should be thick, flat crystal. For night work a luminous pocket compass will be found useful.

*Observations with the Prismatic Compass:*—To take an observation with

the prismatic compass, first adjust the prism by sliding it up and down until the divisions on the circle are seen distinctly; if a tripod stand is used, screw the compass to the ball-and-socket joint, and move the instrument until it is perfectly horizontal (the same precaution must be taken if it is held in the hand); raise the sight-vane, until it is perpendicular; look through the slit in the prism-plate, and bring the thread of the sight-vane in a line with the object; wait until the magnetic needle comes to rest, and read the bearing through the eye-hole in the prism-plate. A bearing thus taken shows the angle which a straight line drawn from the observer, to the object, makes with the magnetic meridian, and is called the magnetic bearing.

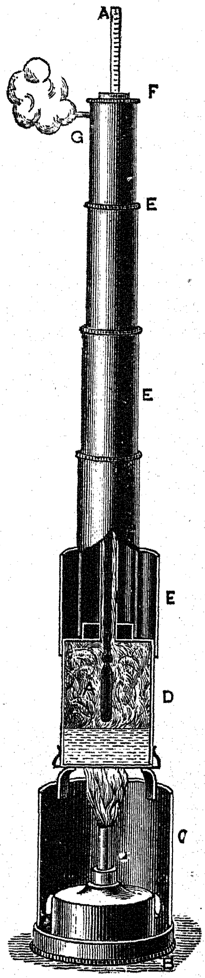
To get the true bearing the magnetic variation must be applied as follows:—If the variation is east *add* it to the bearing, if west *subtract* it, and the result in either case will be the true bearing. Thus: the magnetic bearing of an object was 160° and the variation 20° east, then $160° + 20° = 180°$, the true bearing: the bearing of an object was 160° and the variation 20° west, then $160° - 20° = 140°$, the true bearing; but since the magnetic needle will be affected equally by variation within certain limits of time and space, the difference of the bearing of any two objects, taken from the same station, will be the *angle* subtended by them, as the *difference* in their azimuths will not be affected by the variation.

Where possible, the bearings should be taken at both ends of a base, or line of bearing, the mean of which will be the correct bearing. When the sun's azimuth or amplitude has to be taken, one of the dark glasses should be placed before the slit in the prism-plate, and the mirror should be moved on the sight-vane until the reflected image of the sun is seen in the mirror through the slit in the prism-plate; the bearing is then taken in the manner before described. Great care must be observed when using this instrument to avoid all magnetic rocks, as they may so affect it as to render bearings taken in their vicinity useless.

### *Hypsometrical Apparatus.*

The boiling-point apparatus consists of a thermometer, A, generally graduated from 180° to 215°*; a spirit lamp, B, which fits into the bottom of

* When they are intended to be used at very great elevations, the thermometers will have to be specially constructed with extended scales.




a brass tube, C, that supports the boiler, D; and a telescopic tube, E, which fits tightly on to the top of the boiler. The thermometer is passed down the tube, E, from the top until within a short distance from the water, *which it should never touch*, and is supported in that position by an india-rubber washer, F. The steam passes from the boiler up the tube, E, and escapes by the hole, G. To pack this instrument for travelling, withdraw the thermometer, and put it into a brass tube, lined with india-rubber, having a pad of cotton-wool at each end; take off the tube, E, shut it up, and put the small end into the boiler, D, which it fits, then withdraw the spirit lamp, B, screw the cover over the wick and replace it in C. The whole of this apparatus fits into a circular tin case, 6 inches long, and 2 inches in diameter.

*To use the boiling-point thermometer:*—Take the apparatus to pieces, pour some water into the boiler, D, about one quarter full is quite sufficient; then put the instrument together as shown in the drawing, taking care that the thermometer is just clear of the water, and light the spirit lamp; as soon as the water boils, the steam ascending through the tube, E, will cause the mercury to rise; wait until the mercury becomes stationary, and then read the thermometer; at the same time, take the temperature of the air in the shade with an ordinary thermometer.

If the traveller is visiting a region where the elevations are very great, he should, when purchasing this apparatus, see that the thermometers are capable of registering a greater height than those which are usually supplied, and that the lamp is large enough to hold a good supply

of spirit, as it is a common fault to make it too small, and the tube carrying the wick should be long to prevent overheating the spirit. A screen, which may be made of tin to fold up, is most useful to place on the windward side, and at a very low temperature is almost indispensable, as the heat is otherwise carried off too rapidly for the water to boil properly.

*The Aneroid.*

The general appearance of the aneroid, of usual construction, is so well known that it requires no special description; it is an excellent instrument for laying down contour lines; but for absolute heights it should be checked by the boiling-point thermometer, because its index error is apt to change; when thus checked it is a valuable instrument for measuring heights up to 8000 feet, but at greater elevations it is unreliable. It should be sent to the National Physical Laboratory to be tested, and have its errors determined before and after it has been used by a traveller for the purpose of measuring heights, and during the journey every opportunity should be taken of comparing them with mercurial barometers.

In the majority of cases, aneroids, even when they have been in the first instance correctly graduated, do not read accurately against the mercurial barometer at diminished pressures, and will be found almost always to possess more or less considerable plus or minus errors. These errors are tolerably constant in good instruments, though they are frequently considerably augmented when low pressures have been experienced for a length of time.

Aneroids should be treated with almost as much care as chronometers, and should not be allowed to dangle about the person, or to be shaken up in pockets. If the watch size is employed, they can be conveniently carried in extra watch pockets.*

*Measurement of Heights with the Aneroid*:—To measure the difference in height between two stations, two instruments should be used, and

* On this subject the traveller will do well to read Mr. E. Whymper's book, 'How to use the Aneroid Barometer' (J. Murray, London), and his remarks on the "Watkin Mountain Aneroid" in *The Geographical Journal*, January, 1899.

the readings taken simultaneously at both stations; but it frequently happens that this is impossible, in which case the observations should be taken in the following manner:—State date and hour of observation; take the reading of the aneroid and the temperature of the air, *in the shade*, at the lower station; repeat this at the upper station, and again at the lower station on returning to it, but before taking this last reading a short time should be allowed to let the aneroid take up its proper working, as a descent will always, in a greater or less degree, affect it, unless a Watkin aneroid is used, which is said to be free from this drawback.

In observing with the aneroid, the instrument should always be in the same position, as, for instance, with its face vertical; merely altering the position affects most aneroids with a very sensible difference of reading.

On leaving a station to which it is not intended to return, the reading of the aneroid should be taken, and the temperature in the *shade;* during the day's journey the difference between any reading and that taken at starting will approximately give the difference of height unless there has been some atmospheric change. This is only a very rough way of ascertaining whether a party, passing through a hilly country, has ascended or descended; for the accurate method of computing the difference of height of two stations, see examples (pp. 215, 216).

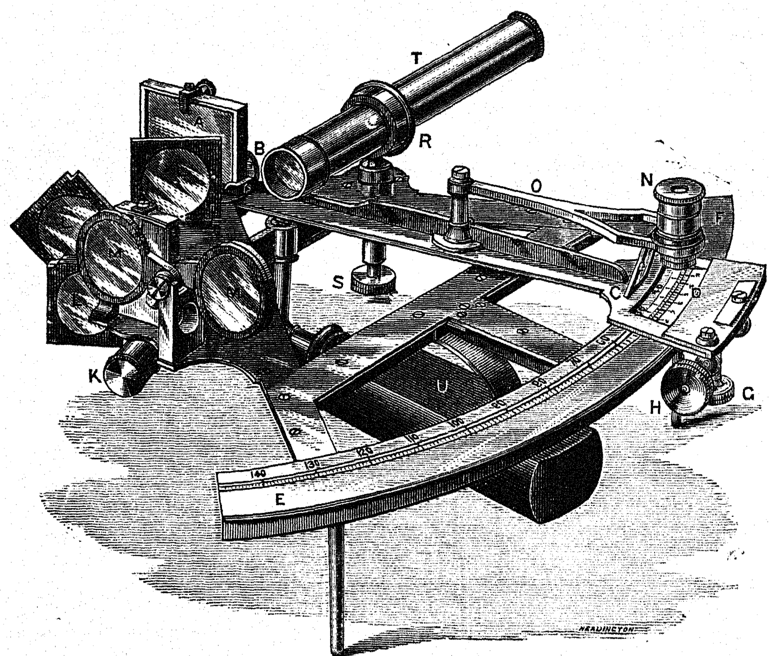
### *The Sextant.*

The principle on which the sextant is constructed is this:—that the angle between the first and last directions of a ray which has suffered two reflections in one plane, is equal to twice the inclination of the reflecting surfaces to each other. The arc on which the angle is measured must therefore be divided into double the number of degrees which properly belong to an arc of the same extent. With this instrument we can measure the angle between two objects, in whatever direction they may be placed, provided the angle is within its limits.

With the aid of the following figure, the different parts of the sextant, with their names, may be distinguished.

A is a plane mirror called the *index glass;* it is set in a frame, and is fixed on a centre perpendicular to the plane of the instrument; it moves with the *index bar* B C, the end of which, C, slides over the *arc* E F, which is graduated (on an inlaid plate of platinum or silver) from 0° to about

140°; each of these degrees, according to the radius of the instrument, is divided into 10′ or 20′, and these are subdivided by the *vernier* D into 10″ or 20″; these divisions on the arc are continued a short distance on the other side of zero (0°) towards F, forming what is termed the arc of excess. The index is secured to the arc by a *clamp screw* G, which must be released when the index has to be moved over a large




portion of the arc. In order to obtain the slow motion necessary for the accurate measurement of an angle, a *tangent screw*, H, is fixed to the index, but does not act until the index is fastened by the clamp screw.

I is a fixed plane glass, the lower half of which, next to the frame of the instrument, is silvered, and the upper half left clear. It is called

the *horizon glass*, and must be perpendicular to the plane of the instrument, in such a position that its plane shall be parallel to the plane of the index glass when the index points to zero (0°) on the arc; it is adjusted by means of the screw K*.

L and M are coloured glasses of different depths of shade, any one or more of which can be turned down in front of either the index or horizon glass to moderate the intensity of the light before reaching the eye, when a bright object, such as the sun, is observed. N is a *microscope* which is carried on a moveable arm O, and can be adjusted to read the divisions on the graduated arc and vernier. T is the *telescope*, at the eye end of which coloured shades can be attached which should always be used when observing the sun in an artificial horizon in preference to the shades L, M. It is carried by a double ring, R, so constructed that it furnishes means of adjusting the line of collimation: this ring is attached to a stem S, which can be raised or lowered until objects seen by reflection, and directly, appear of the same brightness. U is the handle which is often fitted with a brass centre, having a hole in it, to admit of its being fastened to a stand.

*Adjustments of the Sextant.*

The principal are the following:—

1. To make the index glass perpendicular to the plane of the instrument.
2. To make the horizon glass perpendicular to the plane of the instrument, and parallel to the index glass when the index points to zero (0°) on the arc.
3. To make the axis of the telescope parallel to the plane of the instrument, in which the index moves.

1*st Adjustment*.—This adjustment rests with the maker; and being once made cannot be deranged, except by a fall or blow, against which every precaution must be taken. The instrument should, however, be occasionally verified by the observer in the following manner:—Set the

* The form and position of this screw differs very much in different sextants; in many, the adjustment is made by two small screws bearing on the back of the glass.

index at 60°; and, holding the sextant in the left hand, with the right move the index gently backwards and forwards, looking, as you do so, obliquely into the index glass; then, if the image of the arc in the mirror appears in perfect continuation of the arc itself, the adjustment is perfect; when this is not the case, the index glass is out of adjustment. If the derangement is great, the sextant is for the time being useless; if small, it may possibly be remedied by means of certain screws sometimes fitted at the back of the glass; but it is better to leave it alone, as an inexperienced observer would most probably only make it worse. A man who has a thorough knowledge of his instrument can take off the frame, and get it put square and straight. A bad derangement may be remedied in this way; but it is, very evidently, a thing not to be rashly attempted.

*2nd Adjustment.*—Having screwed in the telescope, look through it and the horizon glass at the sun, or still better, a star, and move the index backwards and forwards, on each side of zero (0°), when the reflected image of the object ought to pass exactly over the object itself. If it does not do this, but passes either to the right or left of it, the horizon glass is out of adjustment, and its adjusting screw must be gently turned until the reflected image does pass directly over the object itself.

*3rd Adjustment.*—Screw the telescope firmly into the collar, turn the eye-piece until two of the wires in the focus of the telescope are parallel to the plane of the instrument. Select two stars, not less distant from each other than 90°, bring them into exact contact at the wire nearest to the plane of the instrument; fix the index, and move the instrument so as to throw the images upon the upper wire; if the contact remains perfect the adjustment is perfect: if not, it must be rectified by the two opposing screws in the double collar, taking care to slacken one before tightening the other: the one to slacken is that on the side towards which the contact opens.

*Index Error.*—When the index is set at zero (0°) on the arc, the horizon and index glasses should be parallel, and the two images of a distant object, as a star, should exactly coincide; when this is not the case, it may be remedied by turning a screw in the mounting of the horizon glass. If this adjustment is not made, there will be an error in the place of the *beginning* of the graduation; this is called the Index Error; its amount is easily determined, and, as it affects all angles

alike, it is usual to admit the existence of this source of error, and apply correction for it, in preference to making the adjustment.

*To find the Index Error by a Star.*—Set the index at zero (0°), screw in the telescope, and, with the tangent screw, make the two images of a star, as seen through the telescope, coincide; then the reading on the arc will be the index error. Subtractive when the reading is to the left of zero, additive when to the right.

*By the Sun.*—Clamp the index at about 30′ to the left of zero, and looking through the telescope at the sun, the images will be seen nearly in contact; make this contact perfect with the tangent screw, take the reading, and call this "on the arc"; next, set the index, at about 30′ to the right of zero, and make the contact of the two images perfect as before, take the reading, and call it "off the arc": half the difference of these two readings is the Index Error.

*Examples.*

| (1) | ′ | ″ | (2) | ′ | ″ |
|---|---|---|---|---|---|
| On the arc .. .. .. | 33 | 10 | On the arc .. .. .. | 29 | 30 |
| Off the arc .. .. .. | 29 | 30 | Off the arc .. .. .. | 33 | 10 |
| 2) | 3 | 40 | 2) | 3 | 40 |
| Index corr. *subtract* = | 1 | 50 | Index corr. *add* = | 1 | 50 |

As a check on this observation, for inexperienced observers, it may be noted that one-fourth of the sum of the readings on and off the arc ought to be the sun's semi-diameter, as given in the 'Nautical Almanac.'

*Centering Error.*—In addition to the foregoing, every sextant is liable to errors caused by:—

1. The centre of the pivot of the index-bar carrying the vernier not being identical with the centre of the arc.
2. Imperfect graduation of the arc.
3. Flexure of the whole instrument caused by irregular expansion under the heat of the sun.
4. Shocks or blows which may cause bending of parts of the frame, or of the index bar, and thus cause eccentricity between the vernier and arc.

These errors are generally included in the term "centering error."

The original error included in [1] and [2] can be determined at the National Physical Laboratory, where apparatus for the purpose is established. Those under [3] and [4] are manifestly variable.

In a good sextant the original error should be small, amounting only to a few seconds, but instruments are made which have much larger errors, and as these are enormously multiplied in their effect in some observations, such as lunars, a traveller should always have this error determined before leaving England.

### *The Box or Pocket Sextant.*

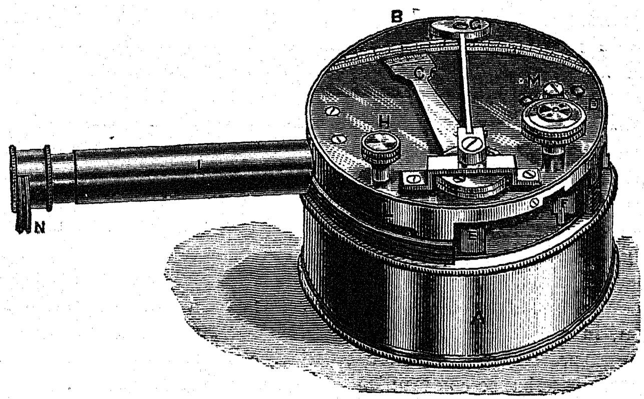
The box sextant is constructed on the same principle as the larger sextant; it is enclosed in a brass box, varying in size from 3 to 4 inches in diameter, and from an inch and a half to two inches deep.

This instrument is very portable, light, and easily adjusted. It is more correct than the compass for measuring horizontal angles, as an angle can be read to within 1′ by means of the vernier on the graduated arc. It can also be used on horseback, and in all sorts of weather, and, when not required for use, can either be carried in the pocket, or slung in a leather case over the shoulder.

The instrument, as shown in the drawing, is ready for use: the *cover*, A, is screwed on to the lower part of the instrument, and serves as a handle when taking an angle; B is a graduated *arc*, divided into degrees and half degrees; C is the *index bar*, having a vernier at the end, divided to read the angle to 1′; D is a *milled screw* by which the index bar is moved; attached to the end of the index bar, on the inside of the box, is the *index glass*, E; the *horizon glass*, F, one half of which is silvered, is also inside the box; G is a small *magnifying glass* attached to the top, to enable the observer to read the angle more clearly; there are dark glasses, to be used when observing the sun, not shown in the drawing. H is the *adjusting screw*, which is screwed into the top for safety; it is made with a square, like a watch-key, and when required for use has to be removed from the position shown in the drawing; I is the *telescope*, which should be fitted at the eye-end with a *revolving disc* N, which is provided with shades of different intensity, to be used with the artificial horizon; in taking angles the instrument can be used without

the telescope, by drawing the *slide*, L, over the hole from which the telescope has been removed.

*Adjustments*:—Having set the index at zero (0°) on the arc, select some object that is sharply defined and perpendicular, as far distant as possible, to be seen clearly; then, holding the instrument in a horizontal position, look at this object through the eye-hole, and, if the reflected image coincides with the object seen directly, the adjustment is so far correct. Then hold the instrument the contrary way, or vertical, look at some object that is level, and if the reflected and real objects are seen in a straight line this adjustment is also correct; but when this is not the case the adjustment




must be made by taking out the *key*, H, placing it in one of the keyholes, M, either on the top or side of the instrument, and turning it gently until the reflected image of the object coincides with the object seen directly. If the reflected image requires moving up or down, the key must be inserted on the top of the instrument, but when it has to be moved to the right or left the key must be inserted at the side.

These adjustments can be made, when no available objects, such as those mentioned, are in sight, by the sun, using a suitable shade. Set the index to zero, and move it until the reflected and direct images coincide; if the index then points to zero (0°) the instrument is in adjustment, if not, make the coincidence with the key as above described. A bright

star may be used in preference to the sun, in which case no shade will be required.

The adjustment by a terrestrial object is here given to meet the case of an instrument having to be adjusted in the day-time when the sun is not visible. Care should be taken when purchasing a box sextant to see that the maker has made the box wide enough to admit a finger to wipe the glasses, as dull reflectors much increase the difficulty of observation.

### *The Artificial Horizon.*

The artificial horizon is a reflector, the surface of which is perfectly horizontal; it is used in combination with the sextant for observing altitudes. Though the principle of all is the same, there are several forms of this instrument, the most common, as well as the best, being a small shallow trough, containing pure, clean mercury,* which reflects the image of a celestial body. This is protected from the disturbing effects of the air by a roof, the two sloping sides of which are made of glass plates accurately ground to true planes: these must be carefully examined to see that they are of uniform thickness and density. Should the traveller have the misfortune to break one of his glasses, and replace it by one not tested, he must be careful to reverse the roof between two observations, or once in a set. Captain George's horizon, in which a glass plate floats on the surface of the mercury, is in some respects more convenient; but it is more liable to errors arising from any disturbance communicated to the mercury by wind.

Another form of artificial horizon is the black plate. It generally consists of a plane of black plate-glass set in a metal frame, and levelled

* The best method of cleaning the mercury is to pass it several times through a funnel of rough paper, the aperture through which it runs being very small, but if the mercury is not pure it gives an imperfect reflection, and its level is apt to be untrue. The quicksilver of commerce is generally mixed with lead, bismuth and zinc, which have to be dissolved out of it by nitric acid; it may, however, in case of emergency, be rendered serviceable by shaking it for some considerable time in a bottle with a little powdered sugar, or even sand, and afterwards straining it through a piece of fine linen or chamois leather, but it is a troublesome and not very satisfactory process.

by a bubble. This form answers fairly well in the day-time, when the sun is the object observed, but at night there is so much loss of light with the black plate that it becomes extremely difficult to use in star observations. In order to overcome this difficulty, artificial horizons of this class have been constructed with a brass frame containing a black plate on one side, for day observations, and a silvered mirror on the other, for night. To the frame are attached fixed levels, by which it can be brought to a true horizontal position. This is a very portable instrument, but its use can only be recommended in the absence of a mercurial horizon, and when the glass used in its composition has been ground into a true plane, and tested at the National Physical Laboratory in the same manner as a sextant index-glass. Every care must be taken to level this instrument accurately, or all observations taken by means of it will be of little value. Any form of artificial horizon that is used should be kept clean and free from dust.

Should the artificial horizon be broken or lost, a substitute may be formed by treacle or other viscous liquid, or even, in calm weather, by water, in a tray or basin.

### *Sextant-Stand.*

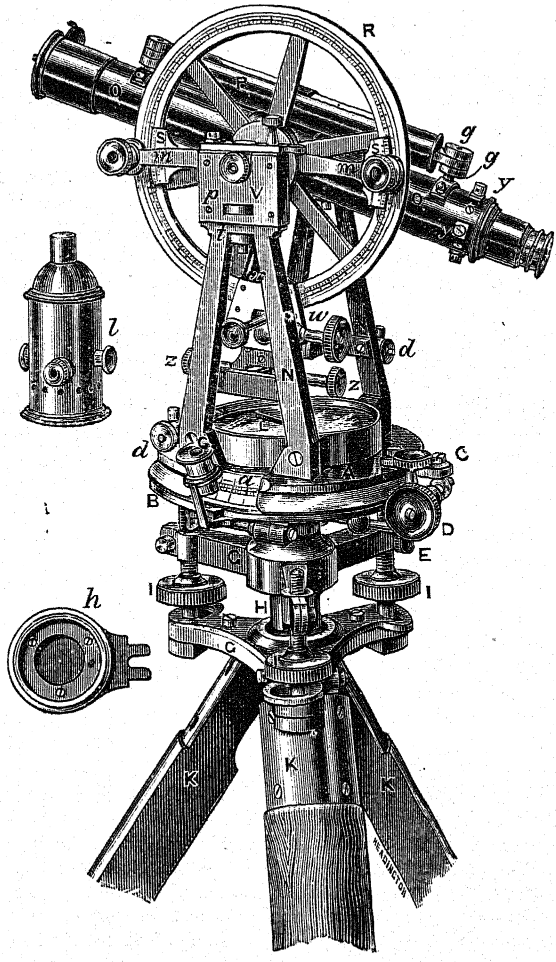
Though sextant-stands vary considerably in the manner in which they are constructed, the object in all cases is the same, viz.:—to provide a means by which the sextant can be fixed in any position convenient to the observer, and also to give that steadiness, so important in sextant observations, which is often wanting in the traveller's hand after a hard day's journey, or an attack of fever. Cary, 7, Pall Mall, has succeeded in making a very convenient form of this instrument, and one that is in many respects superior to the old form. The only adjustments are to place the stand as level as possible, and in such a position that the plane of the sextant shall be in the plane of observation.

### *Transit Theodolite.*

The following are the names of the various parts of this instrument to which reference is made in the remarks on its adjustments.

A is the *Vernier-plate*; it is furnished with two *verniers*, *a*, 180° apart

graduated to read to 10″. B is the *Lower-plate;* it is graduated into 360°, each degree being again subdivided into 10′, and can, with the vernier, be read to 10″. These two plates combined are called the *Horizontal limb,* and revolve independently of one another, but when required, can be made to move together by tightening the *Clamp-screw* C; the slow motion is obtained by the *Tangent-screw* D; the lower plate has also a *Clamp* E, and a *Tangent-screw* F. G G is the *Tribrach System.* H is the *Horizontal axis.* There are three *Levelling screws,* I, I, I. K is the *Tripod,* on which the instrument is firmly screwed; underneath, in the centre, there is a hook (not shown in the drawing) from which to suspend a plummet in order to indicate the exact position where the station peg is to be driven into the ground. The vernier-plate carries a *compass* L in its centre between the supports of the *Telescope* O; it is graduated into 360°, and fitted with a screw M to lift the magnetic needle off its centre when not in use. The two *Frames* N N carry the *bearings* V for the telescope, with its *level* P, and the graduated circle R, called the *Vertical circle,* with its two *verniers* S S, and *Microscopes* *m m.* The vertical circle is graduated from 0° to 90° through one quadrant, then again from 90° to 0° in the next quadrant, and so on round the circle; the degrees are subdivided into 10′, and, with the verniers, read to 10″. Upon the other side of the vertical circle, in most instruments, are marked the number of links to be deducted from each chain, for various angles of inclination, in order to reduce the distances, as measured along the ground at these angles, to the corresponding horizontal distances. The horizontal axis of the telescope is formed of two cones, the larger ends of which are attached to the telescope tube, while the small ends, called the *Pivots, p,* are ground into two perfectly equal cylinders; the pivot which does not carry the vertical limb is pierced, and allows the light of a lamp to fall upon a small reflector (not shown in the drawing) which is screwed into the centre, on the axis of the telescope, and inclined to it at an angle of 45°, by which means the light is thrown directly down the telescope, and illuminates the fine threads, or web, attached to a *Diaphragm* inside the telescope, which is kept in its place and adjusted by the screws *y y,* of which there are four. The *Index-bar, x,* is fixed in its place by the *Clip-screws, z z.* The vertical-limb is furnished with a *Clamp* and a *Tangent-screw, w; d d* are *Levels* at right angles to one another; *l* and *h* are the small *lantern* and its *holder,* which fits into a slot in the frame




*Transit Theodolite.*

on the side opposite to the vertical limb *; *g g* are capstan-headed screws for adjusting the telescope level. The telescope is brought to focus by a milled screw (not shown in drawing) near the object-glass; a diagonal eye-piece is also supplied with the instrument, and is extremely useful in astronomical observations; *t* is a capstan-headed screw used in adjusting the axis of the telescope.

A very useful addition to the transit theodolite is to provide it with a pair of micrometers in the eye-piece, by means of which the distance between the observer and staff of known length can be measured in the manner shown (pp. 37 to 40), in addition to which they increase the efficiency of the instrument for astronomical observation.

### *Adjustments of the Theodolite.*

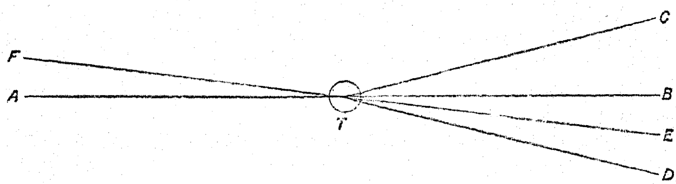
*Parallax.*—This adjustment is made by moving the sliding tube of the eye-piece until the threads of diaphragm are seen sharply defined against the sky, and then by pointing the telescope O at some object, and bringing it to the proper focus by the milled-head screw near the object-glass. To test the accuracy of this adjustment direct the telescope on some well-defined object, about as far distant as the points to be fixed. Intersect this object accurately by using the tangent screws, with the centre of the threads in the diaphragm. Now move the head laterally as far as the field of view will admit, at the same time watching the intersection of the object with the threads. If the object remains stationary on the threads, parallax has been eliminated; but if it does not, the parallax must be removed by turning the focussing-screw until the object remains stationary in whatever position the head of the observer may be.

*Adjustment for Collimation.*—Level the instrument as carefully as possible, then clamp the lower plate B, and, having unclamped the

* As generally supplied by the maker, these lanterns are a constant source of trouble. If there is much wind, it is almost impossible to keep them alight, and even when this has been accomplished, the flickering light they give makes it most difficult to take accurate observations. In practice, except on very calm nights, it is better to dispense with this lantern altogether, and illuminate the wires by fixing a strip of thin white cardboard or thick paper at the object end of the telescope, and bending it over at an angle of about 45° in front of the object glass, then make an assistant throw the light of a lantern on the strip of

vernier-plate A, direct the telescope on some well-defined object, and bring it into coincidence with the point of intersection of the threads of the diaphragm; take the reading on the horizontal limb A B, suppose it to be 20°, then move the vernier-plate, A, half-round, turn the telescope over, and again intersect the object, taking the reading on the horizontal limb, suppose 200° 2′ 30″, take the difference between this and the first reading + 180° (which in the present case would be 200°), and the difference would be 2′ 30″; halve this difference, and subtract it from the second reading, when it is greater than the first reading + 180°, and add it when it is less; this is the mean reading (= 200° 1′ 15″); set and clamp the instrument to this mean reading, and intersect the object by means of the capstan-headed screws *y y*, which move the diaphragm, taking care to loosen one before moving the other. Repeat this operation until the readings taken with the instrument in these two different positions, face right and face left, differ from one another by 180°.

2nd Method.—Set up the theodolite as at T (*see* figure below) and level




it carefully. Set up a stake, with a mark on it, at such a distance that the mark is distinctly visible, as at A. Turn the telescope on it and accurately cover the mark with the intersections of the cross wires in the diaphragm, and clamp it in azimuth. Next turn the telescope over and set up another stake, with a mark on it, at the same distance from the instru-

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cardboard, and the wires will be plainly seen. The intensity of the illumination will be increased or decreased according to the distance at which the lantern is held from the strip of cardboard. A piece of copper wire about eighteen inches long, with a small piece of tin soldered to one end, can be used for the same purpose if wound round the object end of the telescope and bent over the object glass to the required angle; it can be kept in the theodolite box, and is always ready for use. This method of illuminating the wires can be used with a theodolite which has not a hollow axis.

ment as A, and move the stake until the mark on it is accurately covered by the intersection of the wires. If the collimation is in adjustment the stake will be at B, but if not it will be in some other position, such as C. In order to test this unclamp the vernier-plate and turn the instrument half round, and, *without turning the telescope over*, sight to the mark on A, and clamp the instrument in azimuth, turn the telescope over, and if the collimation is out of adjustment it will point to the position D in the figure as far to the right of B as C was to the left. This shows that the collimation of the telescope is not perpendicular to its horizontal axis. In order to correct this, measure the distance from C to D and set up a stake at the middle point B, and another stake midway between B and D, at E. This will be one-fourth of the distance between C D, the amount of adjustment required, and must be made by moving the vertical wire to the right or left by the capstan-headed screws *y y*. The telescope will then be on the line E F, both of which points are respectively equidistant from A and B, so that if the intersection of the cross-wires be accurately placed on a mark on the staff at B and turned over, it will strike the mark on the staff A, and the adjustment for collimation in azimuth will have been made; this is, however, seldom done at the first trial, and the operation has generally to be repeated. In both of these cases the adjustment has been made by the vertical wire.

*Adjustment of the Telescope Level.*—Level the instrument carefully on the azimuth axis H, by means of the levels *d d* on the horizontal limb A B; next, take a pair of verticals, on faces right and left, to any well-defined *terrestrial* object; set the vertical circle R to the mean of these readings, and clamp it; now intersect the object, using the two *screws z z, which clip* the limb of the vertical circle *x*, to the stud in the frames N N, and *not* the tangent-screw W; then repeat the process as before. Remember that after each pair of readings the mean is to be taken, and the object intersected by the clip-screws *z z*, *and not by the tangent-screw W;* and when the readings on the right face agree with the left face, the index error will be 0. Next clamp the vertical circle R at 0° 0′ 0″, and bring the bubble of the telescope level to the middle of its run by means of its adjusting screws *g*, and the level will be in adjustment.

With regard to the clips *z z*, which keep the verniers *s s* in position, never unscrew *both* after the adjustment has been made; but to release the vertical circle before putting the instrument into its box, unscrew

only one of the clips, and mark it so that it may be known, and use this *same* screw when setting up the instrument again. The other clip-screw should never be touched; and, indeed, it would be an improvement if one of the clip-screws were fitted with a lock-nut, by which it would be kept in its proper place, and at once be distinguished from the working screw.

*To make the vertical and horizontal wires respectively vertical and horizontal.*—As these wires are fixed in the diaphragm by the maker so as to cut each other at right angles, it follows that to adjust one wire is to adjust both, and this may be done by the following method:—Level the instrument with care, and intersect any small, well-defined point with the vertical wire, and see if it continues bisected along the wire when the telescope is moved in a vertical plane. If this is not the case the capstan-headed screws *y y* must be slackened sufficiently to allow the diaphragm to be revolved until this condition is secured, when they must again be tightened. It will now be found that the horizontal wire, if properly fixed by the maker, will continue to bisect an object on which it has been placed when the instrument is turned in azimuth.

*Adjustment of the Horizontal Limb.*—Tighten the clamp-screw E, unclamp the vernier-plate A, and turn it round until the telescope is immediately over one of the parallel plate-screws I I; bring the bubble in the telescope level P to the middle of its run by turning the tangent-screw W; turn the vernier-plate 180°, so as to bring the telescope again over the same screw, but with its ends in a reverse position. If the bubble of the telescope level does not remain in the middle of its run, bring it back to that position, *half* by the parallel plate-screws I I, and *half* by the tangent-screw W.* This operation must be repeated until the bubble remains accurately in the centre of its run in both positions of the telescope; now turn the vernier-plate A until the telescope is at right angles to its former position, and bring the bubble to the middle of its run half by the tangent-screw and half by the pair of foot-screws with which the telescope is parallel, reversing it as before until the bubble remains in the middle of its run in both positions.† The bubble should now retain its position, while the vernier-plate is turned completely

* When the level is carried on the vernier arms, the clip-screws must be used, and *not the tangent-screw.*

† If the theodolite is furnished with four parallel plate-screws, they must always be used in pairs *diagonally* opposite to each other.

round, showing that the internal azimuth axis, about which it turns, is truly vertical. Clamp the vernier-plate to the lower plate by turning the clamp-screw C, and loosen the clamp-screw E; move the instrument round its azimuthal axis, and if the bubble retains its central position during a complete revolution, the external azimuth is truly parallel with the internal; when this is not the case, the instrument must be sent to the maker, as this fault cannot be remedied by the traveller.

It is most probable that the levels on the vernier-plate will now be found out of adjustment, and the bubbles must be brought to the middle of their run by turning the capstan-headed screws at the end of each of them.

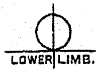
*Horizontality of the Axis of the Telescope.*—This is to be tested by the striding-level, which is supplied with the instrument. Apply it to the pivots *y*, and if the bubble is not in the middle of its run, bring it to that position by turning the capstan-headed screws *t* under the moveable bearing. If there is no striding-level, this adjustment can be tested by observing a long plumb-line, first making the intersection of the threads in the diaphragm coincide with this line, and then, if the point of intersection moves along the line when the telescope is elevated or depressed, the adjustment is perfect; if not, it must be made to do so by turning the capstan-headed screws.

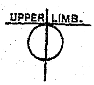
The adjustments can be tested in the following simple manner:—With the plummet supplied with the instrument, find the exact central spot over which the instrument stands; drive a peg into this place, and fasten a cord to the peg; now go in any direction, for say 40 feet, and drive in another peg, stretch the line tight between these pegs, and then intersect the line with the threads in the diaphragm, clamp the horizontal plates, and if the intersection remains perfect while the telescope is moved on its axis, the adjustments are so far correct. Next move the outer peg about 90° (with the same radius) from its first position, and again drive it into the ground and draw the line tight as before; unclamp the vernier-plate, keeping the lower plate clamped, and repeat the previous operation; if the point of intersection of the threads in the diaphragm keeps on the line while the telescope is moved on its axis, the theodolite is in adjustment, if not, the adjustments should be gone over again.

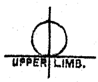
*The Vernier of the Vertical Limb.*—When the foregoing adjustments have been made, set the vernier of the vertical limb to 0° 0′ 0″, and bring the

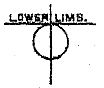
bubble of the telescope level to the middle of its run by turning the clip screws. The instrument will now be in adjustment and ready for use.

All first-class instrument makers are very careful, for the sake of their reputation, to see that the theodolite is in perfect adjustment when it leaves their hands, and, with the careful treatment which this instrument should always receive, is not likely to get out of order; it is, nevertheless, necessary from time to time to test these adjustments.

Observations with the Transit Theodolite should always be taken in pairs, with the vertical circle first to the *right* and then to the *left*, and the mean of results should be taken. When a diagonal eye-piece is used for observing altitudes of the sun, the lower limb has this appearance 

and the upper limb this, 

. When observing altitudes of the sun with the inverting telescope, it must be remembered that what appears to be the lower limb is really the upper, thus: 

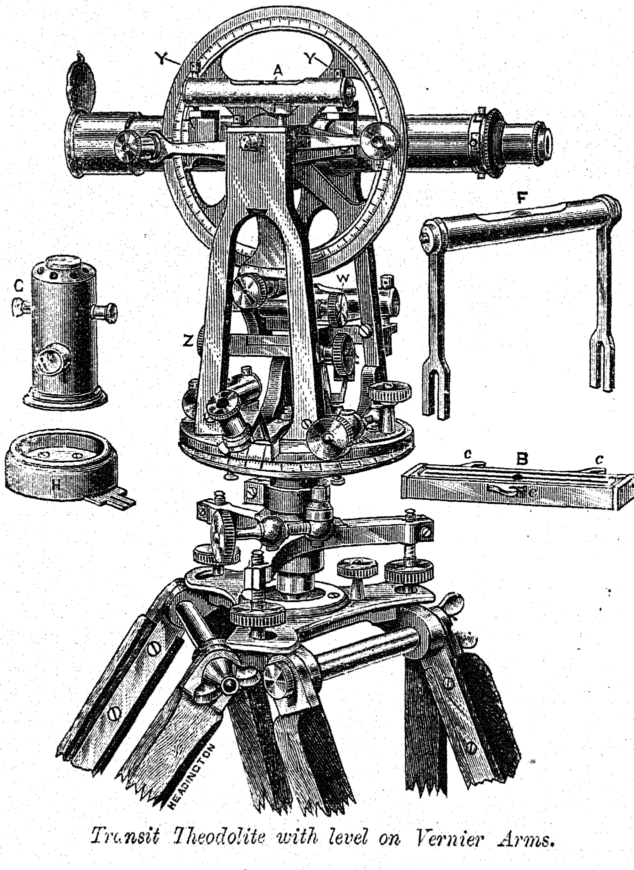
and 

. Where the direct telescope is used the reverse is the case.

Another form of transit theodolite, in which the level A is carried on the vernier arms instead of being attached to the telescope, is shown p. 32. The magnetic needle B is also attached to the instrument in a different manner, being in all respects similar to the one used with the plane table, and is described p. 42. This is so constructed that it can be attached, by the hooks C C C, to the under part of the instrument. The adjustments of this instrument are identical with those previously given for the more common form of transit theodolite,* with the exception of that for the vernier arm level A, which is adjusted in the following manner:—First set the instrument carefully by the levels on the vernier-plate, and then by means of the *clip screws* Z Z bring the bubble of the level, A, on the vernier arms to the middle of its run. Next unclamp the vertical circle and place

* See note, p. 29.

the intersection of the hairs in the telescope, accurately, on some well-defined distant object, take the reading of the vertical circle, unclamp the instrument, turn it through 180°, reverse the telescope, again place the bubble in the middle of its run by the clip-screws, and cover




*Transit Theodolite with level on Vernier Arms.*

the object with the intersection of the telescope hairs, and take the reading of the vertical circle. The mean of these two readings (face right and face left) will be the true reading to which the vernier of the vertical arc must be set, by the tangent-screw W. Then by means of the *clip screws* Z Z again cover the object with the intersection of the telescope hairs. This operation should be repeated until the reading of the vertical circle is the same with the telescope in both positions. When this has been accomplished, the bubble of the level on the vernier arms must be brought to the middle of its run by the capstan-headed screws Y Y at the end of the level-tube.

The method of ascertaining the value of the divisions of the level scale, and of applying the correction for dislevelment to the vernier angles, is as follows * :—

By means of the clip screws move the bubble up to one end of its run, say towards the object end, so that the object end of the bubble corresponds approximately with the extreme reading of the scale. Intersect with the horizontal wire some convenient object for observing. Read and record one end of the bubble, say the object end, and the vertical angle. Now, by means of the clip screws, bring the bubble back towards the eye as far as you can, taking care that it is really floating, and within the graduations of the scale. Reintersect the same object as before, and record the vertical angle and the reading of the object end of the bubble in its new position. The difference between the two readings of the object end of the bubble gives the dislevelment in terms of divisions of the scale, and the difference between the two vertical angles gives the same dislevelment in minutes and seconds of arc. Dividing this angular measurement by the number of divisions of dislevelment, you obtain the value of one division of the scale in arc.

Thus :—

| | Elevation. | Object end of bubble. |
|---|---|---|
| 1st observation . . . . | 7° 3′ 28″ | 18 divisions |
| 2nd " . . . . | 7 0 0 | 5 |
| Difference . . . . | 0 3 28 | 13 |

$$\text{Value of one division} = \frac{208''}{13} = 16''.$$

* This method is taken from 'Text-Book of Military Topography,' Part II., 1898.

This operation must be repeated several times in order to get a good mean value. The bubble of a level is very susceptible to changes of temperature (heat makes it lengthen and cold contracts it), so care must be taken that it is not exposed to such changes while this operation is being performed. Should there be any chance of the bubble altering its length while you are determining the value of the divisions of the scale, it will be necessary to read and record both ends of the bubble. In observing, as described previously, for each vertical angle taken, the readings of both ends of the bubble must be recorded. To apply the correction the rule is as follows:—

Divide the difference between the sums of the readings of the object end and eye end by the total number of readings, and the result will be the dislevelment in terms of divisions of the scale. Multiply this result by the angular value of one division of the scale, and you obtain the angular correction for dislevelment to be applied to the mean vertical angle. Supposing two observations are taken to a point one face left and one face right, and the readings are as follows:—

| | O. | E. |
|---|---|---|
| F. L. . . | 5 | 8 |
| F. R. . . | 7 | 6 |
| | 12 | 14 |

In this case the sum of the readings of the eye end exceeds that of the object end by two. The number of readings of ends of the bubble is four. So to get the dislevelment in terms of division of the scale we must divide 2 by 4 = $\frac{1}{2}$. Suppose the value of one division of the level scale is 16 seconds, then to get the correction we must multiply $\frac{1}{2}$ by $16'' = 8$ seconds. The eight seconds of arc must be applied to the mean of the two observed angles. With regard to its sign, the eye end being in excess, the correction must be subtracted from an elevation and added to a depression. If the object end were in excess, the process would, of course, be reversed, or correction to altitude =

$$+\frac{O-E}{\text{number of readings}} \times \text{value of 1 division.}$$

The magnetic needle is used in the following manner:—Attach it

underneath the vernier-plate by means of the hooks C C C provided for that purpose. Set the vernier of the horizontal plates to 360°, and then keep the upper plate clamped. Unclamp the lower plate and turn the whole instrument round until the magnetic needle points nearly to the central division in the box, clamp the lower plate, and make the needle point exactly to this division. The telescope will now point to magnetic North, and if the *upper* plate is unclamped and turned on to any object, its magnetic bearing can be read from the verniers. Care must, of course, be taken to keep the lower plate firmly clamped.

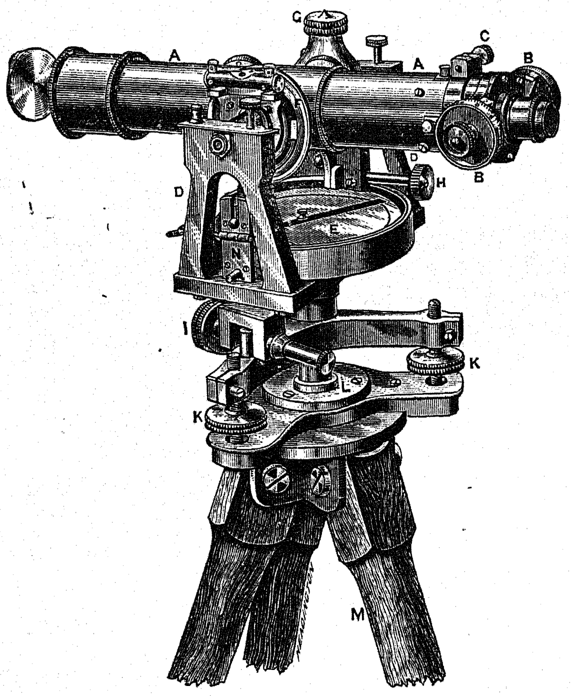
F is the striding level which can be used in levelling the transit axis. G is the lantern which is placed on the stand H after it has been fixed to the standards, and is used to illuminate the threads of the diaphragm, through the hollow axis K, when star observations are being taken.

### *Tacheometer.*

A Tacheometer is an instrument for measuring small angles. Of the many different types of tacheometers in use by surveyors the form adopted by the Indian Government, and made by Messrs. Troughton & Simms, is best suited to meet the requirements of the traveller. It consists of a *telescope* A, fitted with a pair of *micrometers*, B B, which are used for measuring either vertical or horizontal angles, as they can be turned through an angle of 90°, and fixed in that position by the *screw* C. The telescope is mounted on *standards* D D, over a *prismatic compass* E, and is furnished with a *small circle*, F, for taking vertical angles, which can be read to minutes. G is the screw by which it is clamped in altitude; H is the *vertical slow motion screw.* The instrument is fitted with a screw (not shown in the plate) for clamping it horizontally, and I is the *horizontal slow motion screw.* The bearing of any object is read through the *prism* N. There are three *levelling screws*, K, which fit into a *tribrach* L, that screws on a *tripod* M. The instrument is levelled by means of the screws K, and a level attached to one of the standards (not shown in the plate).

There is a disc of glass visible in the field of view, divided in such a

manner that each division equals one revolution of the micrometer head, and each micrometer head is divided into 100 parts. These divisions are



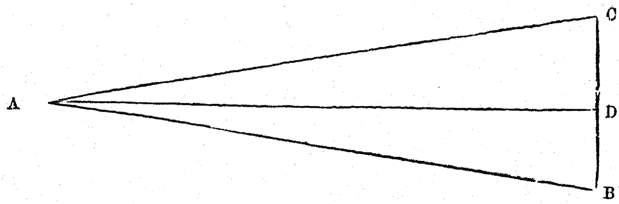

*Tacheometer.*

both vertical and horizontal, to suit the corresponding positions in which the micrometers are used.

The measurement of distances by means of the tacheometer is based on the solution of a triangle.

In Fig. 1, suppose the instrument to be at A, and a staff of known length to be represented by BC; then if the angle BAC is measured, and

FIG. 1.




the length of the staff BC is known, the distance AD can be easily computed. In order, however, to measure the angle BAC, the value of the micrometer divisions must be determined in the following manner:—Set the telescope to *solar focus*, and carefully measure the distance AD from the instrument to a staff of known length; measure the angle BAC subtended by the staff with each micrometer, carefully noting the number of divisions and decimals of a division used with each. Divide the length of the rod by the distance AD between the instrument and the rod, and multiply this by the cosecant of $1'' = 206265$, and the result will be the value of the angle BAC in *seconds* as measured by that micrometer. Now divide BAC in *seconds* by the number of micrometer divisions used in taking it, and the result will be the value of each division of the micrometer in seconds and decimals of a second. As the value of the divisions will not be exactly the same in both micrometers their values must be separately determined. *It should be borne in mind that the values of the micrometer divisions must be determined at solar focus and the instrument used subsequently at solar focus, otherwise wrong values will be given for the micrometer divisions.*

*Example*:—Number of divisions used (Right Micrometer), 1157·1; length of rod, 12 feet; distance between rod and instrument, 983·2 feet.

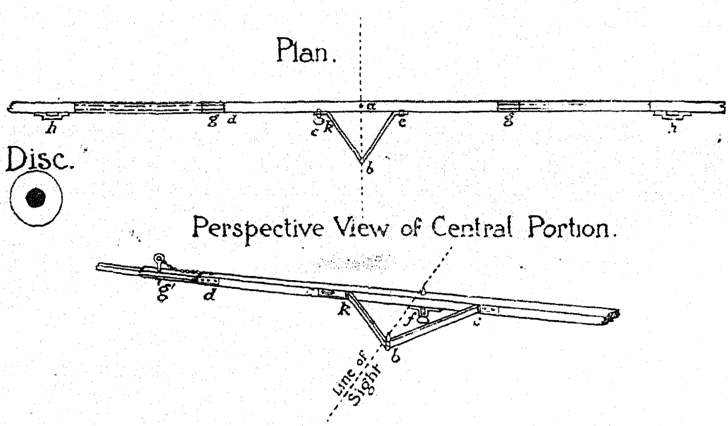
| | |
|---|---|
| Log 12 = 1·079181 | |
| Log distance 983·2 = 2·992642 | |
| $\bar{2}$·086539 | |
| Cosecant of $1'' = 206265$ Log = 5·314425 | |
| The whole $\angle$ = 2517·″46 = Log 3·400964 | |

$$
\begin{array}{r}
1157{\cdot}1)\,2517{\cdot}460''\,(2{\cdot}17 \left\{ \begin{array}{c}\text{Value of each}\\ \text{division.}\end{array}\right. \\
\underline{23142} \\
20326 \\
\underline{11571} \\
87550 \\
\underline{80997}
\end{array}
$$

The same process would have to be gone through to find the value of a division of the Left Micrometer.

In combination with this instrument a rod of known length is generally used. Fig. 2 represents a rod devised by Lt.-Col. St. G. C. Gore, R.E., Surveyor-General for India.

Fig. 2.




The bar is made of hard wood in three sections. The central section is square in cross section $1\frac{3}{8}'' \times 1\frac{3}{8}''$ with iron sockets six inches long, *g*, *g*, at each end, into which the outer portions of the bar fit, being pinned into place by the pins *g'*. The outer ends of the bar carry iron sockets, *h*, *h*, which have the recesses in them accurately machined out. Into these sockets the discs *i* fit by means of carefully fitted hooks on their backs. The discs are of wood ten inches in diameter, painted white with a black ring. Black cloth covers are also carried to fit tightly over the discs, in case of working with a light background.

In the centre of the bar is a brass socket plate, by means of which the bar can be attached to a tripod.

The sighting arrangement consists of a light iron frame, hinged at *e*, *b* and *k*. The pin of the hinge *b* carries a point on the top, and a similar metal point is fixed at *a* in the centre of the bar. The end of the

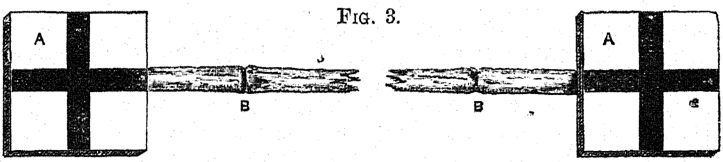
frame *e* is screwed to the bar, and the other end is fixed by a thumbscrew *c* in such a position that the line joining *b a* is at right angles to the line joining the discs. For travelling, the thumbscrew *c* is unscrewed and the frame is closed up against the bar, in which position the thumbscrew screws into the hole *d* in a metal plate affixed to the bar. The bar is fixed in position by an assistant looking along the sights *a*, *b*, and laying them on to the theodolite.

Fig. 3 represents another form of rod and one more easily made, though not calculated to give such accurate results. A A are two boards, one foot square, painted white, with a black cross on each. These are fastened on a bamboo, B B, in such a manner that the centres of the crosses shall be a known distance apart.

When using the rod in a vertical position it will often be found convenient to fasten a stick to it, so that it shall extend about two feet beyond one of the boards. This, when placed on the ground, takes the weight of the rod and helps the assistant to keep it steady.

Any theodolite can be used as a tacheometer, by having hairs in the diaphragm fixed at such a distance apart as to read one foot on a staff when it is one hundred feet distant from the instrument, two feet when

FIG. 3.




the staff is two hundred feet distant, and so on, and a theodolite fitted in this manner will always give a proportion of 1 to 100 between the reading on the *graduated* staff and the distance. As the power of the telescope is usually small, the figures and marks on the graduated staff can only be read at a comparatively short distance.

The following precautions must be taken, or no accurate results can be obtained. The fixed hairs must be adjusted to read in the proportion of 1 to 100, or, what is the same thing, the staff must be marked to read one foot, when it is 100 feet distant from a certain point. It is the determination of where this point is that is absolutely necessary, and the place from which to measure the distance is arrived at in the following manner:—

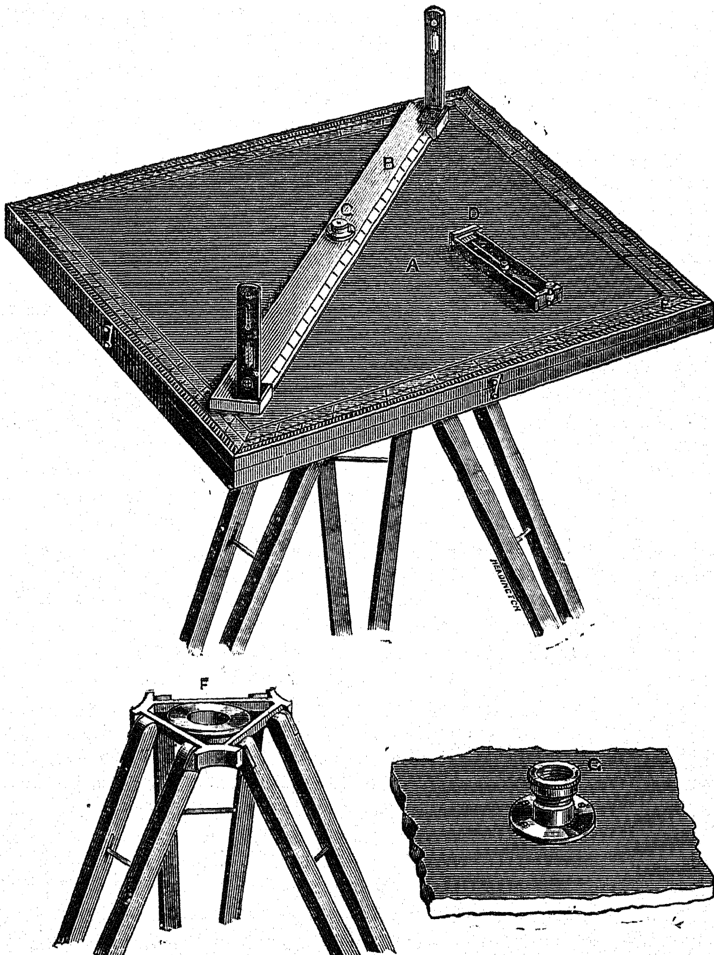
Mark the ground immediately under the centre of the instrument by dropping the plummet from the centre of the tripod, in the usual manner, and from this measure a distance, in the direction the telescope points, equal to the focal length of the object-glass, added to the distance from the object-glass to the vertical centre of the instrument. Thus, if the focal length of the object-glass was 12 inches, and the distance of the object-glass from the vertical centre of the instrument was 7 inches, then the position of the point from which to commence the measurement of the 100 feet would be 19 inches from the place where the plummet let fall from the centre of the tripod touched the ground. The telescope must always be set to *solar focus*, otherwise no accurate results can be obtained.

To all distances measured in this manner a constant, equal to the focal length of the object-glass + the distance of the object-glass from the vertical centre of the instrument, must be added, otherwise there will be an increasing error in each distance that is measured. (*For instructions for using this instrument in the field, see pp.* 111 *to* 116.)

### *The Plane Table.*

The plane table is, in substance, a drawing board fixed on a tripod, so that lines may be drawn on it by a ruler placed so as to point to any object in sight. Its advantage is, that it enables a survey to be made without the aid of, and in less time than with other instruments.

All its other parts are mere additions to render this operation more convenient, and accurate. Though the principle on which all plane tables are constructed is the same, they vary considerably in detail. Those, for instance, used by the United States Coast Survey, and several of the European Governments, are very elaborate instruments, fitted with parallel plates and levelling screws, having also a telescope in the place of the ordinary sights. The plane table then becomes an instrument of precision, but is much more liable to sustain injury from accident than in its rougher form, not more so, however, than a theodolite or sextant. The levelling screws enable the traveller to set up his instrument much more expeditiously and accurately than he possibly could without them, and with the telescope he will be able to see distant objects that would otherwise be too indistinct to be made use of in the survey.




*The Plane Table.*

*The Table.*—A is a rectangular board of well-seasoned wood, and can, within certain limits, be made of any size to suit the work intended to be done. To this board the paper to be drawn on may be attached either by drawing-pins, clamping-plates, or a box-wood frame, E, which is usually graduated in the same manner as a protractor, and can be used to measure horizontal angles, when the fiducial edge of the ruler is placed against a pin in a small hole, in a brass plate in the centre of the table, which is provided for the purpose. A stud, on the under part of the table, fits into a socket in the *tripod*, F; the table can then be revolved to any horizontal position, and there fixed by tightening the large *nut*, G, on the clamping-screw attached to the stud.

*The Tripod*, F, should be a split one, and for convenience of packing the legs should telescope. This arrangement is also convenient for setting up the instrument on sloping ground. The screws for tightening the tripod legs should be enlarged at the end so as to prevent their falling out. In many cases it will be convenient to have the plane-table tripod so made that it can be used for the other instruments.

*The Alidade*, B, is a flat ruler, having a fiducial edge, each end of which carries a sight-vane. In the sight-vane, three or four small holes should be drilled at intervals, as it is often very difficult to see objects through the slit. On the centre of the ruler is a small *circular level*, C, to be used in setting up the table. In mountainous countries a small telescope fitted on the alidade will be found very convenient, and where this is not the case, and the elevation or depression of an object to be intersected is more than can be embraced by the sights, the intersection must be effected with the assistance of a plummet suspended in the exact ray, either before the object sight or behind the eye-sight as may be required.

*The Compass*, D, should have a needle about four inches long, contained in a rectangular metal box, and is so arranged that when the needle points to north it will be parallel to the outer straight edge of the box.

A pair of compasses, paper, india-rubber, pencils, a pen-knife, and some pins, complete the essentials for plane-table work.

It is not considered necessary, in these "Hints," to give any detailed description of the more elaborate forms of the plane table, but any person desiring information on the subject can obtain it by applying to the Instructor at the Society's rooms. (*For instructions for using this instrument in the field, see pp.* 97 *to* 109.)

*Watches.*

The keyless half-chronometer is the most suitable watch for a traveller in wild countries. (The half-chronometer watch is an English lever watch, with compensation balance, and a carefully-tempered balance spring.)

The ordinary pocket chronometer is not calculated to stand the rough usage to which most travellers' watches are subjected. The objections to it are: (1) The extreme delicacy of the escapement and liability to injury from rust or accident. (2) Its great liability to stoppage from various causes, such as a sudden jerk when riding or travelling over a rough country; even if in the act of winding it the holder should inadvertently give a circular motion to his hand in a direction opposite to that in which the balance-wheel is moving at the same instant, it may stop. (When a chronometer is once stopped it will not start again unless a circular motion be given to it.) (3) The impossibility of its repair when injured, except by high-skilled workmen, and when very slightly injured, the consequent great disturbance and irregularity in its rate.

Under favourable circumstances, and in skilled hands, pocket chronometers have done good service, but this is exceptional. The minimum price of a good pocket chronometer, in a silver case, is 45*l*.

Half-chronometers are not liable to stop from the before-mentioned causes, and they are more easily repaired. They may be carried in the pocket under conditions of rough usage, short of actual violence, and under ordinary circumstances their performances are frequently but little inferior to those of a chronometer at rest.

Of late years, great improvements have been made in the manufacture of the lever escapement, compensation balances, and the balance springs, upon which the ability of a watch to keep a steady rate in a great measure depends. The keyless mechanism has also been perfected, and it is not necessary to open the case of a keyless watch in order to wind it; thus the works receive increased security from dust and damp, the two great enemies of all time-pieces.

The following is the description of such a watch as would be best suited to a traveller. The watch should be an 18-size half-chronometer;

the bezel (or frame which holds the glass) should have neither hinge nor spring, but should fit very closely over the watch-case, and snap tightly when pressed home, or screw on, as is the case with the watches supplied to travellers by this Society. Great care should be taken to see that the marking of the minutes on the dial is correct, so that in whatever part of the hour circle the minute hand shall point to a division, the seconds hand shall at the same time point to 0. This perfect coincidence for the whole circle of the dial is by no means common; its absence is chiefly due to the great difficulty of getting the dial painters to divide every minute division exactly to a second as marked in the seconds dial, and the error is often so great as to be a cause of annoyance to the traveller, who will have frequent difficulty in deciding as to which minute the seconds belong. The seconds dial-plate should be sunk, and the glass should be thick flat crystal. The cost of a good watch of this description varies from 30*l.*–40*l.*, according as to whether it is a going-barrel or fusee. The latter is preferable, as it is certain that the fusee watch will keep an exact proportion of its daily rate throughout the twenty-four hours, and it is also fitted with an up and down dial, showing when the watch was last wound, and when it will require winding, a very important thing for exploring work in unknown regions. Both fusee and going-barrel watches for observation purposes should be "free sprung," as a much steadier rate is obtained therewith.

The keyless watch has many advantages over the old form, of which the following are some:—It cannot be wound the wrong way. It cannot be over-wound, and the case has not to be opened for winding. When the glass and back are made to screw on, as made by Herbert Blockley, 41, Duke Street, St. James's, and the winding-button is fitted with a screw cap, a watch of this kind has been placed in water, and proved impervious to damp after several hours' immersion. Should the winding mechanism get out of order, the watch can be wound with a common key in the same manner as an ordinary watch.

Care should be taken to wind a watch at about the same hour every day, and as nearly as possible to subject it to the same daily treatment with regard to its position in the pocket, or the place where it is laid down at night.

In purchasing a watch, be sure to go direct to the manufacturers, and make them responsible for it.

Cheaper watches, *purporting* to have compensation balances, and the best balance springs, may be obtained from many shops; but it will often be found (when too late to replace them) that they are not all they profess to be, that they have never been properly adjusted, and are, in consequence, so affected by change of position and temperature as to be useless for scientific purposes.

Persons not having much experience with watches frequently expect too much from them, and are under the impression that if a watch maintains a good rate in England, this rate will remain unchanged in the tropics, where the heat is great. This is not the case, as the rates of all watches, no matter how carefully compensated they may have been, will undergo a change if subjected to great variations of temperature, and it is absolutely necessary that frequent observations should be taken for determining the rate of the watch under these altered circumstances by one of the methods given, pp. 153, 154, 162 and 163. It must also be remembered that if a watch is allowed to run down, it will probably take quite a different rate when again set going, and that the rate of a watch when lying down almost always differs slightly from what it is when carried, hence the necessity for the traveller to take the time of his observations for error and rate, while carrying the watch in the same manner he intends to do during his journey.

## PART II.

# PLANE TRIGONOMETRY, PRELIMINARY REMARKS, AND MAP PROJECTIONS.

The following formulæ are of frequent use in all surveying problems. In right-angled triangles, B being the right angle, if either A or C is known, the other is found by subtracting the known angle from 90°. For the rest we have:

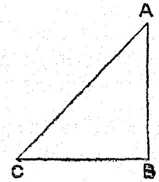



TABLE I.

| Case. | Given. | Required. | Solution. |
|---|---|---|---|
| 1 | Hyp. A C<br>Angles .. | Base C B..<br>Perp. A B | $CB = AC \times \cos C$.<br>$AB = AC \times \sin C$. |
| 2 & 3 | Base C B<br>Angles .. | Perp. A B<br>Hyp. A C | $AB = CB \times \tan C$.<br>$AC = CB \times \sec C$. |
| 4 & 5 | Hyp. A C<br>Perp. A B | Angles ..<br>Base B C | $\sin C = AB \div AC$; $\cos A = AB \div AC$.<br>$BC = \sqrt{(AC + AB) \times (AC - AB)}$. |
| 6 | Perp. A B<br>Base B C | Angles ..<br>Hyp. A C | $\tan C = AB \div BC$; $\cot A = AB \div BC$.<br>$AC = BC \times \sec C$. |

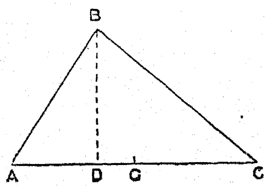


TABLE II.

| Case. | Given. | Required. | Solution. |
|---|---|---|---|
| 1 | The angles and side A B. | Side B C<br>Side A C | $BC = AB \times \sin A \times \operatorname{cosec} C$.<br>$AC = AB \times \sin B \times \operatorname{cosec} C$. |
| 2 & 3 | Two sides A B, B C, and angle C opposite to one of them. | Angle A<br>Angle B<br>Side A C | $\sin A = \sin C \times BC \div AB$.<br>$B = 180^\circ - (A + C)$.<br>$AC = AB \times \sin B \times \operatorname{cosec} C$. |
| 4 & 5 | Two sides A B, A C, and the included Angle A. | Angles C and B<br><br>Side B C | $\tan \frac{B - C}{2} = (AC - AB) \times \cot \frac{A}{2} \div (AC + AB)$.<br>and, $\frac{B + C}{2} = 90^\circ - \frac{A}{2}$ : from which<br>$B = \frac{B + C}{2} + \frac{B - C}{2}$ : and $C = \frac{B + C}{2} - \frac{B - C}{2}$.<br>$BC = AB \times \sin A \times \operatorname{cosec} C$. |
| 6 | All three sides. | All the Angles | From half the sum of the three sides, subtract, separately, each of the three sides. Multiply these four numbers (the half sum and the three remainders) together, and take twice the square root of the product. This result, divided by the product of any two of the sides, gives the sine of the angle between them. |

In all plane triangles, if two of the angles are known, the third angle is found by subtracting the sum of the two from 180°.

The foregoing equations may be solved by multiplication and division, with a table of natural sines, cosines, &c.; but, in order to avoid such a tedious process, logarithms are usually employed. In calculating with logarithms, multiplication is performed by adding together the logarithms of the numbers to be multiplied: the sum is the logarithm of the product: division is performed by subtracting the logarithm of the divisor from the logarithm of the dividend; the remainder is the logarithm of the quotient. *Twice* the logarithm of a number is the logarithm of its square; and *half* its logarithm is the logarithm of its square root.

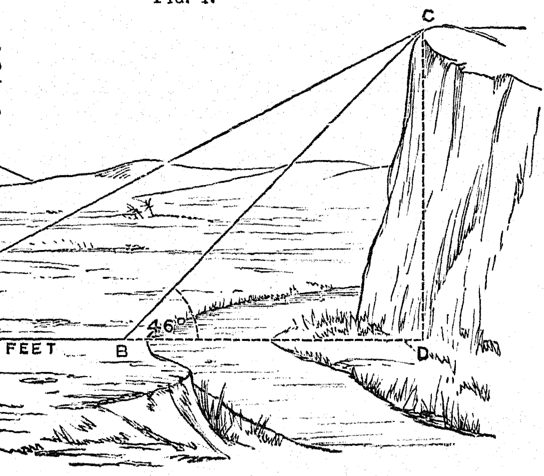
The following are some of the most useful examples of the practicr application of the rules given in Tables I. and II.:—

(1.) Wishing to ascertain the height of a point C (Fig. 1), which could not be approached nearer than B, I observed the angle of altitude C B D = 46°, and measured the distance from B to A = 200 feet, at which place I found the angle C A B = 29°.

Having found the ∠ A C B as above, I then computed the length of B C by *Case* 1, *Table II.* Then, as the ∠ C D B = 90°, I computed the height C D by *Case* 1, *Table I.*

FIG. 1.

From ∠ C B D = 46°
Take ∠ C A B = 29
∠ A C B = 17

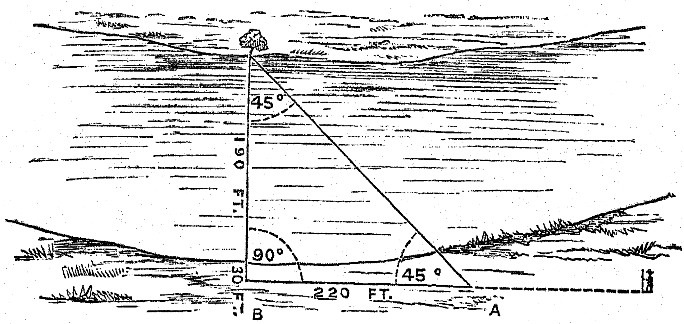



(2.) To measure the breadth of a river when standing at B (Fig. 2), a short distance from it, I sent on a man with a staff to a distance which I judged to be greater than the breadth of the river. I then motioned him to the right and left until he was in such a position that the reflected image of the staff was shown exactly over a tree on the opposite bank (as seen directly), when I had 90° on the arc of my sextant: having set my sextant to 45°, I walked in a straight line towards the staff until I reached a position, A, where, on looking through my sextant, I saw the reflected image of the tree shown exactly over a mark set up at B (as seen directly). I then measured the distance from A to B, which I found to be 220 feet;

from this I subtracted 30 feet, the distance from the water, and this gave me the breadth of the river, 190 feet.

(3.) In order to measure the breadth of a river I set up a mark, A (Fig. 3), close to the water; from this point I measured a base of 200 yards,

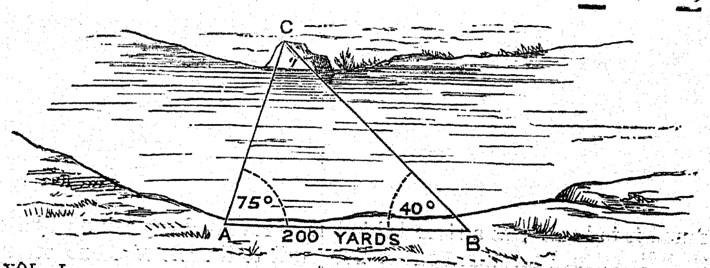
Fig. 2.




parallel to the course of the river, and set up another mark, B. The angles, subtended by a rock on the opposite bank and each end of the base, were A 75°, B 40°. I then computed the breadth of the river by *Case* 1, *Table II.*

| | | | |
|---|---|---|---|
| $\angle A$ | $75°$ | | $180°$ |
| $\angle B$ | $40$ | | $115$ |
| | $115$ | $\angle C =$ | $65$ |

Fig. 3.



(4.) To ascertain the height of an inaccessible point, A (Fig. 4), above my position C, I measured its angle of elevation with a theodolite, and

Fig. 4.

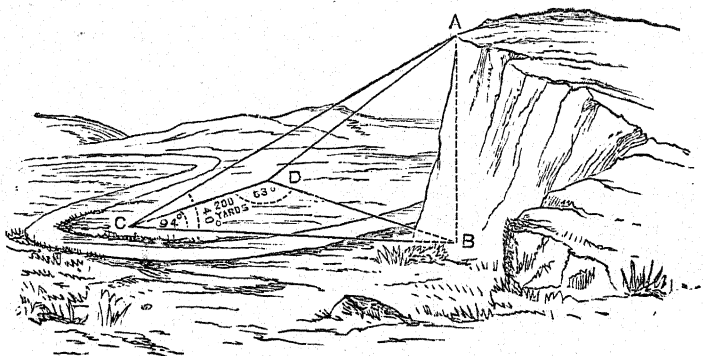
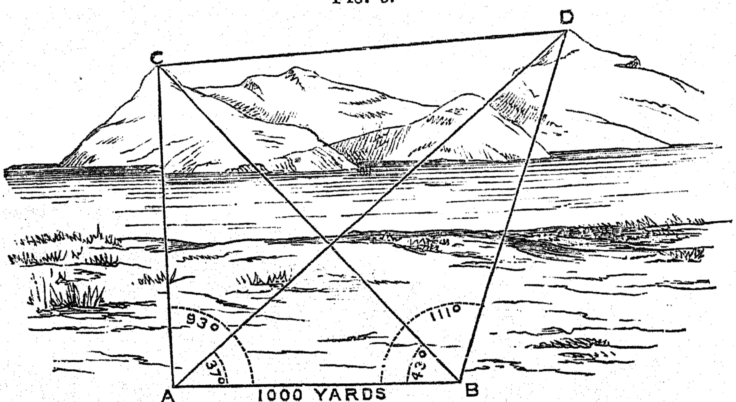



Fig. 5.




found it to be 40°; as a river behind me prevented my taking a base in that direction, I measured one of 200 yards to the left of C and set up a

mark D. The angles subtended by A, at each end of the base, were found to be, C 94°, D 63°; with these angles and the base C D, I computed the side B C by *Case* 1, *Table II.* Then, as B C is the base of the right-angled triangle A B C, I computed the height of the A by *Case* 2, *Table I.* Should a sextant be used, the angles A C D and A D C will be taken, and with these, and the base C D, compute the side A C by *Case* 1, *Table II.* Then as A C is the hypothenuse of the right-angled triangle A B C, the height of the point A can be computed by *Case* 1, *Table I.*

(5.) The distance between two inaccessible peaks C and D (Fig. 5) being required, I measured a base, A B, of 1000 yards, setting up a mark at each end. I then measured the angles between the two peaks, at both ends of the base, and found them to be:—at A, 37° and 93°; at B, 43° and 111°. In the triangle A B C, by subtracting the sum of angles A and B, = 136°, from 180°, I found the angle C to be 44°; by a similar process I found the angle D in the triangle A B D to be 32°, and in the triangle B C D, by subtracting 43°, the smaller angle, from 111°, the greater, I found the angle at B = 68°. Having thus found all the necessary data in the triangle A B C, I computed the side C B (*Case* 1, *Table II.*), and in the triangle A B D, I computed the side D B (*Case* 1, *Table II.*). With the sides C B and B D, of the triangle B C D and the included angle B, I computed the side D C (the distance between the inaccessible peaks) by *Cases* 4 and 5, *Table II.*

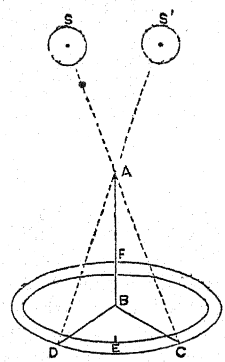
*To find the Meridian by a Watch.*

When the sun is visible, the position of the meridian line can be approximately determined in the following manner by a watch set to local time:—Turn the face of the watch to the sun in such a manner that the hour-hand shall point to the sun, or, in other words, until the hour-hand itself shall be directly over its shadow. Half-way between the place of the hour-hand and XII. will be the south point in north latitude, and the opposite point of the dial will be the north point. In south latitude the reverse of this would be the case, while in the tropics the position of the north and south points would depend on whether the

sun, when on the meridian, is north or south of the observer. When the sun is near the zenith this method would be of little use.

*To find the Meridian by the Sun, without instruments.*

Having levelled a piece of ground of sufficient size, plant a rod in a truly perpendicular position, testing it with a plumb-line, and at an hour or two before noon (say 10.30) mark accurately the extremity, C, of the shadow, B C, thrown by the rod when the sun is in the position S; then from the base, B, of the rod as a centre, with the radius B C, the length of the shadow, describe the circle, D C F, upon the ground. As the sun's altitude increases, the shadow of the rod will fall within the circumference of the circle, and will gradually grow shorter until noon; after which, as the sun's altitude decreases, the shadow of the rod will grow longer until, at last, when the sun has attained the position S′, it will

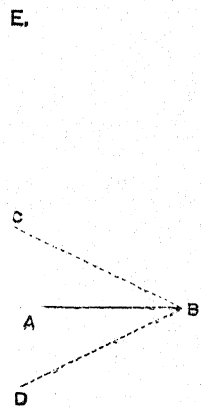



reach the circumference of the circle at the point D. Divide the arc C D, into two equal parts, and from E, a point equi-distant from C and D, draw a line through the centre B, and that line will coincide, approximately, with the true meridian.

## Extemporary Measurements.

*To set off a Right Angle from any point on the ground by means of a Rope.*

To set off, from any point A, a line at right angles to a given direction, as A E, measure an equal distance on each side of A, in the same straight line as A E, this equal distance *being about one-fourth of the length of the rope.* Let C and D be these points. Fasten the ends of the rope at C and D, and having ascertained the centre of the rope by doubling it, the centre should be drawn out towards B, until D B and C B are tight. Then E A B will be a right angle; therefore, as we are thus able to set off a right angle to any line, the distance of any inaccessible object may be obtained by either of the three following ways:—




*To find the Distance of an inaccessible object with a Measuring Line.*

By Fig. 1, p. 54.—From the line A D measure off the perpendiculars A C, D E, ranging the point C in line with E B, then

$$A\,B = \frac{A\,C \times A\,D}{D\,E - A\,C}.$$

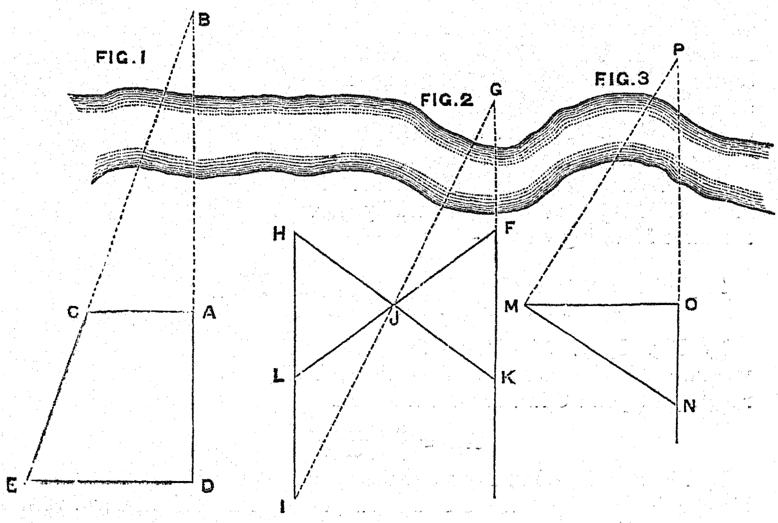
By Fig. 2, p. 54.—Fix any convenient points H and K. Join H K and bisect it in J; make J L = J F, and range I in line with H L and with J G; then L I = F G.

By Fig. 3, p. 54.—Set off O M at right angles to O P, and M N at right angles to M P; then $O\,P = \frac{O\,M^2}{O\,N}$.

## Rough Methods of Measuring.

Rough angular measurements may be taken by the span at arm's length. From the end of the thumb to the end of the middle finger subtends an angle of 15°; the full span to the end of the little finger

subtends an angle of 18°. This may be easily checked by spanning round the horizon; twenty spans make the circuit. It is at all times well to know the length of the different joints of the limbs. Suppose the nail-joint of the forefinger to be 1 inch, the next joint will be 1¼ inches, the next 2 inches, and from the knuckle to the wrist 4 inches; in this case the finger is bent, so that each joint may be measured separately, though, when held straight, the distance from the tip of the forefinger to




the wrist would be only 7 inches. The span with thumb and forefinger would be 8 inches, and with the thumb and any of the other three 9 inches, or equal to the length of the foot; from the wrist to the elbow would be 10 inches, and from elbow to forefinger 17 inches, and from collar-bone to forefinger 2 feet 8 inches; height to the middle of the kneecap 18 inches. From the elbow to the forefinger is usually called a cubit, but it is seldom strictly so, an English cubit being generally stated as 18 inches. In like manner the full stretch of the extended arms is called a fathom; but it is generally somewhat less.

The pace is commonly supposed to be $2\frac{1}{2}$ feet, but this is a most uncertain mode of measurement. Very few men, *without practice*, can take correctly a hundred consecutive steps or paces of the same length. Practice will determine the amount of ground covered in a certain number of paces, if tried over known distances; it of course varies, but from experiment the mean has been found nearly as follows:—

Pacing, at 30 inches per pace, of 108 in a minute, equals 270 feet, or 3·068 statute, or 2·66 geographical miles per hour.

Pacing quickly, at 30 inches per pace, of 120 in a minute, equals 300 feet, or 3·41 statute, or 2·96 geographical miles per hour.

Pacing slowly, at 36 inches, may average 60 per minute, equals 180 feet, or 2·04 statute, or 1·78 geographical miles per hour.

### *Distance by Sound.*

Sound travels at the rate of about 1090 feet in one second in calm weather and temperature 32° Fahr., and increases at the rate of 1·15 foot for each degree of temperature above 32°; a moderate breeze accelerates or retards sound by about 20 feet in a second. When a gun is used to measure distance it should always be pointed at an angle of about 45° to the horizon. This method will be found most useful in making rough surveys of winding rivers or lakes, where it is impossible to land on account of the dense undergrowth or the swampy nature of the banks. Greater accuracy may be obtained if a gun is fired at each end. A base for a small triangulation can be measured by this means.

### *Ascertaining Heights by Angles of Elevation.*

When using an angle of elevation to ascertain the difference of height of a mountain top and the position of the observer, it must be recollected that, if at any considerable distance, a large part of the mountain is below the horizontal line, and therefore the perpendicular of a right-angled triangle will only represent a portion of the height. To allow for this, the following correction, which includes mean refraction and curvature, must be added to the true angle of elevation.

$$\text{Correction, in seconds of arc,} = \frac{\text{distance in geog. miles} \times 100}{4}$$

*Example.*—Observed with a theodolite the elevation of Kilimanjaro to be 6° 3′ from a position afterwards found to be 25 miles distant.

$$\text{Correction} = \frac{25 \times 100}{4} = 625'' = 10'\,25''$$

Corrected elevation = 6° 03′ + 10′ 25″ = 6° 13′ 25″

| | |
|---|---|
| Constant log. (of 6046 ft.) . . . . . . | 3·7815 |
| Log. tangent 6° 13′ 25″ . . . . . . | 9·0376 |
| Log. 25 . . . . . . . . . | 1·3979 |
| Height above observer's position = 16,480 feet . log = | 4·2170 |

### Flashing Signals.

A flash from a small mirror is of the greatest use in surveying. Mirrors mounted so as to turn in any direction are sold by opticians under the name of heliostats, and a flash from one of two inches square may be seen fifty miles. It requires, however, an intelligent person to direct the mirror, and cannot therefore be worked by a native or untrained European. Mirrors fitted for this purpose are made of accurately parallel plate glass, and a small hole is made in the silvered surface and the plate protecting the back of the glass.

Planting the stand of the mirror fairly, the hole in the centre is looked through, and a piece of paper working on a stick, which must be stuck in the ground about ten paces distant, is brought into exact line with the object to which it is desired to flash and when the observer is in readiness to take the angle to the flash. The mirror is then turned about until the flash from the sun illuminates the paper, when the observer at the distant point will also see it. The flash must be kept carefully on the paper until an answering flash shows that it has been seen and observed.

Two surveyors working together in this way can obtain most accurate observations without any time being expended in erecting marks. In a persistently cloudy climate, the method is, of course, of little use.

### Measurement of the Number of Cubic Feet of Water conveyed by a River in each Second.

The data required are—the area of the river-section and the average velocity of the whole of the current. All that a traveller is likely to obtain, without special equipment, is the area of the river-section and the

average velocity of the *surface* of the current, which is greater than that of its entire body, owing to frictional retardation at the bottom.

To make the necessary measurements, choose a place where the river runs steadily in a straight and deep channel, and where a boat can be had. Prepare a few floats of dry bushes with paper flags, and be assured they will act. Post an assistant on the river-bank, at a measured distance, of about half the estimated width of the river, down stream, in face of a well-marked object. Row across stream in a straight line, keeping two objects on a line in order to maintain your course. Sound at intervals from shore to shore, fixing your position on each occasion, by a sextant-angle between your starting-place and your assistant's station, and throw the floats overboard, signalling to your assistant when you do so, that he may note the interval that elapses before they severally arrive opposite to him. Take an angle from the opposite shore, to give the breadth of the river.

To make the calculation approximately, protract the section of the river on a paper ruled to scale in square feet, and count the number of squares in the area of the section. Multiply this by the number of feet between you and the assistant, and divide by the number of seconds that the floats occupied, on an average, in reaching him.

Important rivers should always be measured above and below their confluence; for it settles the question of their relative sizes, and throws great light on the rainfall over their respective basins. The sectional area at the time of highest water, as shown by marks on the banks, and the slope of the bed, ought also to be ascertained.

EXAMPLE.

| DISTANCE FROM SHORE | Starting place. | | | | | | | | | Opposite Shore. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Whence the boat started, measured in feet .. .. .. .. | 0 | 90 | 160 | 240 | 330 | 420 | 500 | 600 | 700 | 780 | |
| Depth at those distances measured in feet .. .. .. .. | 0 | 2 | 3½ | 4 | 4 | 5½ | 7 | 6½ | 3½ | 0 | |
| Time required for float to drift opposite to assistant, measured in seconds .. .. .. | 0 | 48 | 50 | 40 | 33 | 29 | 27 | 30 | 50 | 0 | Average. 38·4 |

Distance of assistant, in feet, 150.

By protracting the data on the first two lines, on ruled paper as described above, it will be found that the area of the section is 3260 feet, or thereabouts; this, multiplied by 150, gives 489,000 cubic feet of water as the contents of the river at any given moment between the line of soundings and the assistant. As this amount passes by in 38·4 seconds, the number of cubic feet per second is the former number divided by the latter, which gives 12,734.

It must be distinctly understood that this number is only roughly approximate, and that it is excessive. However, with the above data, an engineer would be able to make a somewhat better calculation. In the meanwhile, the traveller might consider the flow of the river in question to be between 10,000 and 13,000 feet per second.

## Map Projections.

### *Mercator's Projection.*

On a sheet of cartridge paper, 13 inches by 20, it is proposed to construct a map on Mercator's projection, on a scale of 10 geographical miles to an inch equatorial—*i.e.* 6 inches to the degree of longitude.

$$\text{Limits of the Map} \begin{cases} \text{Lat. } 31° \text{ to } 33° \text{ N.} \\ \text{Long. } 34° \text{ to } 36° \text{ E.} \end{cases}$$

Draw a base line, find its centre, and erect a perpendicular to the top of the paper; the extremes of longitude 34° and 36° added together and divided by 2, give 35°, the central meridian, and which is represented by the perpendicular; on each side of it lay off 6 inches, and erect perpendiculars for the meridians 34 and 36; divide the base line into 10 geographical mile divisions, and the part from 35° 50′ to 36° 00′ into geographical miles for the latitude scale.

From Table A, take the following quantities:—

| | | | | | | |
|---|---|---|---|---|---|---|
| Lat. 31° to 32° = 1° 10′·4 = the distance between parallels | | | | 31° | and | 32° |
| „ 32° to 33° = 1° 11′·1 | „ | „ | „ | 32° | „ | 33° |
| 2° 21′·5 | „ | „ | „ | 31° | „ | 33° |

Having thus obtained the distances between the required parallels, divide the map into squares of 10′ each way, and the map is ready for the projection of the route.

## (A.)—Table to construct Maps on Mercator's Projection.

| ° | 0° | 1° | 2° | 3° | 4° | 5° | 6° | 7° | 8° | 9° |
|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 0 | | 1 00 | 1 00·1 | 1 00·1 | 1 00·1 | 1 00·2 | 1 00·3 | 1 00·4 | 1 00·5 | 1 00·6 |
| 10 | 1 00·9 | 1 01 | 1 01·2 | 1 01·5 | 1 01·7 | 1 02 | 1 02·2 | 1 02·6 | 1 02·9 | 1 03·3 |
| 20 | 1 03·6 | 1 04·1 | 1 04·5 | 1 04·9 | 1 05·5 | 1 05·9 | 1 06·5 | 1 07 | 1 07·7 | 1 08·2 |
| 30 | 1 09 | 1 09·6 | 1 10·4 | 1 11·1 | 1 12 | 1 12·8 | 1 13·7 | 1 14·6 | 1 15·7 | 1 16 |
| 40 | 1 17·6 | 1 19 | 1 20·1 | 1 21·4 | 1 22·7 | 1 24·2 | 1 25·6 | 1 27·1 | 1 28·8 | 1 30·6 |
| 50 | 1 32·4 | 1 34·3 | 1 36·4 | 1 38·6 | 1 40·8 | 1 43·4 | 1 45·9 | 1 49 | 1 51·4 | 1 54·8 |
| 60 | 1 58·3 | 2 01·8 | 2 05·8 | 2 09·9 | 2 14·5 | 2 19·1 | 2 24·7 | 2 30·5 | 2 36·8 | 2 43·8 |
| 70 | 2 51·3 | 2 59·8 | 3 09·1 | 3 19·6 | 3 31·3 | 3 44·6 | 3 59·8 | 4 17·1 | 4 37·4 | 5 01·1 |
| 80 | 5 29·5 | 6 03 | 6 46·4 | 7 40·3 | 8 51·1 | 10 27·7 | 12 47·9 | 16 29·6 | 23 4·3 | 39 42·2 |

### Use of the Table.

Find in the Table the required parallel: the tens at the side, and the units at the top. At their intersection will be found, in degrees and minutes, the distance of the required parallel from the next less degree; to be measured from the scale of longitude on the map in progress.

Given the parallel of 30°—required that of 31°.

30 at the side, and 1 at the top, intersects at 1° 09′·6, the required distance of the two parallels.

Given the parallel of 31°—required that of 33°.

$$\begin{array}{rl} 32^\circ = & 1^\circ\ 10'\cdot 4 \\ 33^\circ = & 1^\circ\ 11'\cdot 1 \\ \hline & 2^\circ\ 21'\cdot 5 \end{array}$$

2° 21′·5 the distance between the 31° and 33° parallel.

## (B.)—Given the Departure, to find the Difference of Longitude.

| ° | 0° | 1° | 2° | 3° | 4° | 5° | 6° | 7° | 8° | 9° |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 1·0001 | 1·0006 | 1·0013 | 1·0026 | 1·0038 | 1·0055 | 1·0075 | 1·0098 | 1·0125 |
| 10 | 1·0154 | 1·0187 | 1·0224 | 1·0261 | 1·0306 | 1·0353 | 1·0403 | 1·0457 | 1·0514 | 1·0578 |
| 20 | 1·0642 | 1·0711 | 1·0785 | 1·0864 | 1·0946 | 1·1034 | 1·1126 | 1·1224 | 1·1326 | 1·1434 |
| 30 | 1·1547 | 1·1666 | 1·1792 | 1·1924 | 1·2062 | 1·2208 | 1·2361 | 1·2521 | 1·2690 | 1·2868 |
| 40 | 1·3054 | 1·3250 | 1·3456 | 1·3673 | 1·3902 | 1·4142 | 1·4395 | 1·4663 | 1·4945 | 1·5242 |
| 50 | 1·5557 | 1·5890 | 1·6242 | 1·6616 | 1·7013 | 1·7435 | 1·7883 | 1·8361 | 1·8871 | 1·9416 |
| 60 | 2·0000 | 2·0626 | 2·1301 | 2·2027 | 2·2812 | 2·3662 | 2·4586 | 2·5593 | 2·6695 | 2·7904 |
| 70 | 2·9238 | 3·0716 | 3·2361 | 3·4204 | 3·6280 | 3·8637 | 4·1337 | 4·4454 | 4·8097 | 5·2406 |
| 80 | 5·7587 | 6·3925 | 7·1856 | 8·2057 | 9·5664 | 11·4750 | 14·3340 | 19·1080 | 28·6530 | 57·3070 |

### Use of the Table.

Find in the Table the required parallel, the tens at the side, and the units at the top: at their intersection will be found a quantity which, multiplied by the departure, gives the "diff. of longitude."

The departure from the meridian on the parallel of 34° was 25 miles—required the diff. of longitude.

$25 \times 1·2062 = 30·155$ the diff. of longitude.

In the parallel of 60° the departure was 30 miles.

$30' \times 2 = 60$ miles, or 1 degree.

In the parallel of 35° N. the route was N. 40 W., 37 miles' distance.

Dis. Dep. Miles.

By Traverse Table, 40° course, $37 = 23·8 \times 1·2208 = 29·055$ diff. of longitude.

*Modifications of the Conical Projection.*

When it is intended to represent any portion of a country situated in high latitudes, it will be necessary, to prevent distortion, to make use of the conical projection, or some modification of it; and if the area it is intended to include is of small extent, it will be desirable to draw the map on a larger scale than when it is to comprise an extensive portion of the globe. In many cases it would be found that the centre from which the parallels would have to be described, according to the conical projection, would lie so far outside the extent of the map as to render it extremely inconvenient to describe the curves representing the parallels, when the following method should be adopted, by which this difficulty will be overcome.

In the following example the projection includes an area comprised between the 50th and 56th degrees of north latitude, and from the 2nd to the 6th degree of west longitude.

Having decided on the scale on which the map is to be drawn, construct a diagonal scale (*see* Fig. 2) in the following manner:—

On a line equal to the length of one degree of latitude of the scale decided on, erect a perpendicular at each end, also equal to the length of one degree of latitude, and join these lines, thus forming a square, the sides of which are equal to one degree of latitude of the scale of the map. Next carefully divide each of the perpendiculars into six equal parts, and join these by diagonal lines from 0 to 10, 10 to 20, and so on, as shown (*see* Fig. 2). Next divide the lines at the top and bottom of the square into ten equal parts, and join them by parallel lines; these lines will then constitute decimal divisions of the diagonals, and any measure can now be taken from this scale which is not less than a sixtieth of the degree.

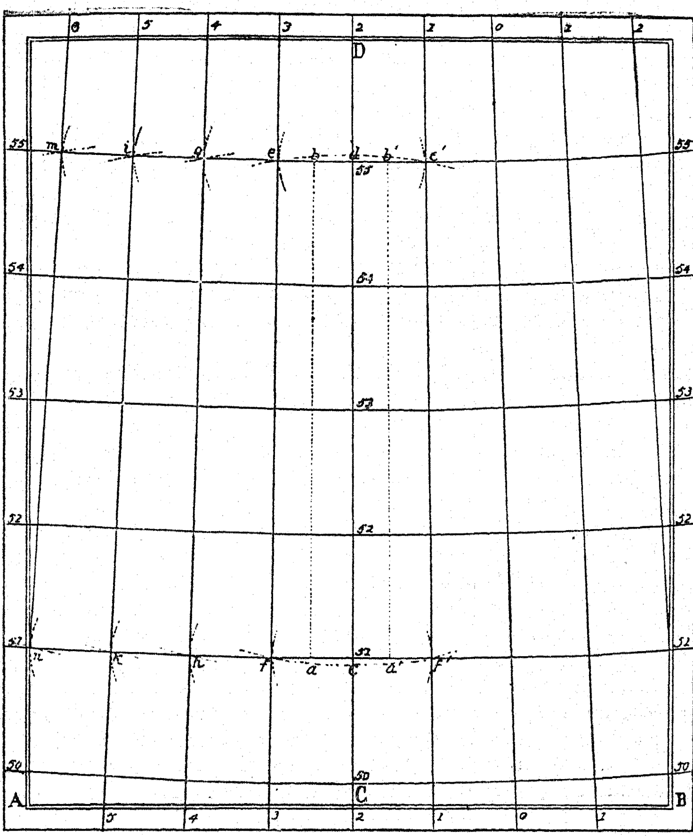
Having constructed the diagonal scale, draw a base line, A B, near the bottom of the sheet of paper, and erect the perpendicular, C D, to represent the central meridian of the map, which in this case is 2° west longitude, and taking from the diagonal scale, with the compasses, the length of one degree of latitude, measure off six of these degrees from C towards D, leaving between the base line and the first a space equal to 10′ of latitude for a small part of the country which extends to

the south of the 50th parallel. Number these divisions 50, 51, 52, etc., and through the 51st and 55th * draw lines of an indefinite length at right angles to C D. Next, by the aid of the table (p. 256), ascertain the lengths of a degree of longitude on the parallels of 51° and 55°, which are shown on the diagonal scale by the lines *x x*, and *y y*. On the line drawn parallel to A B, from the point *c*, through which the first parallel is to pass, set off on each side of the central meridian C D the spaces *c a*, *c a'*, each equal to the half of *x x*, or half a degree of longitude in that parallel; and in the same way at the 55th degree of latitude, set off the spaces *d b*, *d b'*, each equal to half of the line *y y*: then draw the lines *a b*, *a' b'*, and the quadrilateral figure thus formed will constitute the projection of half a degree of longitude upon each side of the central meridian. In order to carry this onward to a whole degree on either side, extend a pair of compasses between the points *a b'*, or *a' b*, which will thus measure the *diagonals* of an entire degree, and, fixing one leg of the compass at the point *c*, describe, with the radius *a b'*, the arc *e e'*, and from the point *d*, with the same radius, the arc *f f'*; then from the point *c*, with the radius *a a'* (= *x x*, *see* diagonal scale), and from the point *d*, with *b b'* (= *y y*, *see* diagonal scale), as radii, describe arcs intersecting the others in the points *f*, *f'*, *e*, *e'*; join the points *c f*, *c f'*, *d e*, *d e'*, by straight lines, and draw lines passing through *e f*, *e' f'* (which will represent meridians), and the projection will be formed for 1° on each side of C D.

This process must be carried out on each side of C D as far as the map requires; thus from the points *f* and *e*, with the same diagonal *a b'* as a radius, the arcs *g*, *h* must be described and intersected by other arcs measuring the lines *x x*, *y y*; and in the same way from the corresponding points *e' f'*. In the present case (*see* Fig. 1) this is carried on to a distance of 4° of longitude, on each side of C D, and the lines *c f*, *f h*, *h k*, *k n*; *d e*, *e g*, *g i*, *i m*, joining the points thus found, will give the proper amount of curvature to the parallels which they represent. As these parallels include 4° of latitude, the lines *e f*, *g h*, etc., must be divided into four equal parts, and a space equal to one of these parts, or 1°, set off upon each of the meridians above and below the parallels already drawn. These divisions being then joined

* These parallels are chosen because the errors in distance inherent to the projection are more nearly balanced throughout the map.

FIG. 1.


D
C
A
B
55
54
53
52
51
50
m
i
g
e
b
d
b'
c'
n
k
h
f
a
c
a'
f'

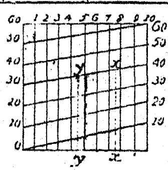

60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10
Y
X
y
x

FIG. 2.

by straight lines, the intermediate and extreme parallels will also be obtained; and all that remains to be done is to draw the lines forming the border of the map, and mark on them the divisions and numbering of the degrees.

In this example the meridians converge towards the top of the map as the latitude is north, but these rules apply equally in south latitude, only the meridians will in that case be found to converge towards the bottom.

When bearings taken at any station have to be shown on the map, they must be laid off from *the meridian passing through that station.*

The following projection, which is employed in the Indian Government Surveys, is another modification of the conical development, and is used for projecting a map on a plane table sheet. It represents the parallels of latitude by concentric arcs, but the meridians by arcs concave to the central meridian, and not by straight lines as in the true conical development. A cone is assumed to roll over the spheroid tangentially to an adopted central parallel of latitude; the distance from the vertex of the cone to this parallel (= normal × cot latitude) is the radius of projection of the parallel, and may be considered as the fundamental radius of the projection; for the radii of all other parallels are determined by adding to or subtracting from it the distances between those parallels and the central parallel. The angle subtended at the vertex of the cone by a longitudinal arc of 1° in length is called the "angle of the projection" for the parallel of latitude to which the arc appertains; as this angle varies with the latitude, its value is computed for each parallel.

The quantities given in the tables are: $m = \mathrm{Q\,R}$ or $\mathrm{P\,S}$ (Fig. 3), the meridional distance between the parallels there stated, $n = \mathrm{P\,Q}$ and $p = \mathrm{S\,R}$, the lengths of the corresponding portions of these parallels, and $q = \mathrm{S\,Q}$ or $\mathrm{R\,P}$ the diagonal of the square: $m$ is obtained from Table B, and $n$ and $p$ from Table A by simple proportion, while $q$ may be determined by proportion from Table C or as follows:—

$$q^2 = m^2 + n^2 - 2\,m\,n \cos \mathrm{P},$$

$$\text{and } q^2 = m^2 + p^2 + 2\,m\,p \cos \mathrm{P},$$

$$\text{since angle R} = 180° - \text{angle P};$$

$$\text{therefore } q^2 = m^2 + n\,p,$$

$$\text{and } q = \sqrt{m^2 + n\,p}.$$

These tables are for use in constructing the graticules of maps, or the network of lines representing parallels and meridians. Suppose that a graticule has to be drawn comprising 4° of latitude and 4° of longitude between the latitudes $\lambda°$ and $\lambda° + 4°$, on any particular scale. Construct with great accuracy, on a piece of tracing paper, a quadrilateral figure, P Q R S (Fig. 3), whose sides P Q = $n$ and S R = $p$ shall be the length of a degree of parallel in latitudes $\lambda°$ and $\lambda° + 1°$ respectively, and whose sides P S and Q R each = $m$ shall be the meridional distance between those parallels. Construct also a similar quadrilateral for parallels $\lambda° + 3°$ and $\lambda° + 4°$.

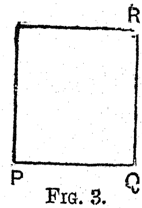



FIG. 3.

Draw a line, H C, down the middle of the paper to represent the

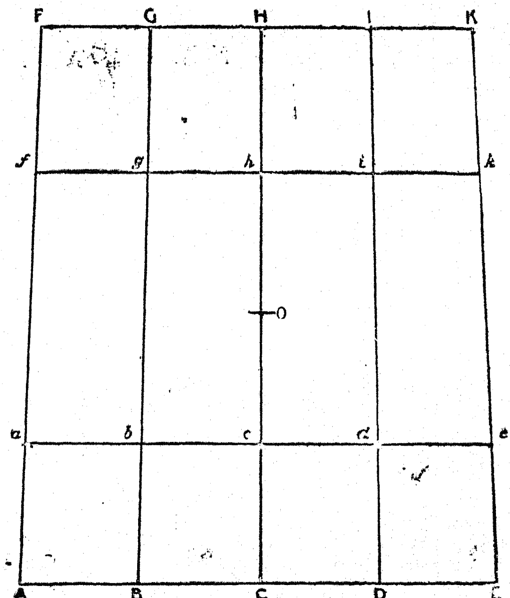



FIG. 4.

central meridian, and cut off parts C *c*, *c* O, O *h*, and *h* H each to represent a degree in the corresponding latitude on the given scale. Place the first quadrilateral with Q R on C *c* and prick through the point P, thus giving the point B: similarly placing the second quadrilateral on H *h* obtain the point G. Join B G and cut off B *b* = C *c*, and G *g* = H *h*. With B *b* and G *g* as bases for starting, proceed as before and determine the points A and F and the line A F, which will be one of the outside meridians. A similar process on the other side of H C will give the points D, E, I, K. Join the points A B, B C, C D, D E, etc., and F G, G H, H I, I K, etc., and we get the parallels of latitude which cut each of the meridians at the same angle, different for each parallel. We have now only to divide the lines *f a*, *g b*, etc., into parts equal to *h* O and O *c*, and unite the points of intersection, and the graticule is complete. The practical check on the process is that if it has been constructed accurately, the meridians A F, B G, D I, and E K will be sensibly equal to the central meridian C H, and the diagonals A H, C F, C K, E H will be sensibly equal to each other.

## (A.)—Table giving the Linear Value in Miles of a Degree of Arc measured along Parallels of Latitude.

| Latitude. | Longitudinal Degrees in Miles. | Difference. | Latitude. | Longitudinal Degrees in Miles. | Difference. |
|---|---|---|---|---|---|
| ° | | | ° | | |
| 0 | 69·1618 | — | 23 | 63 6960 | — |
| 1 | 69·1513 | 105 | 24 | 63 2171 | 4789 |
| 2 | 69·1199 | 314 | 25 | 62·7190 | 4981 |
| 3 | 69·0676 | 523 | 26 | 62·2019 | 5171 |
| 4 | 68·9944 | 732 | 27 | 61·6658 | 5361 |
| 5 | 68·9003 | 941 | 28 | 61·1109 | 5549 |
| 6 | 68·7854 | 1149 | 29 | 60·5375 | 5734 |
| 7 | 68·6496 | 1358 | 30 | 59·9456 | 5919 |
| 8 | 68·4931 | 1565 | 31 | 59·3355 | 6101 |
| 9 | 68·3158 | 1773 | 32 | 58·7072 | 6283 |
| 10 | 68·1179 | 1979 | 33 | 58·0611 | 6461 |
| 11 | 67·8993 | 2186 | 34 | 57·3973 | 6638 |
| 12 | 67·6601 | 2392 | 35 | 56·7160 | 6813 |
| 13 | 67·4005 | 2596 | 36 | 56·0173 | 6987 |
| 14 | 67·1204 | 2801 | 37 | 55·3015 | 7158 |
| 15 | 66·8200 | 3004 | 38 | 54·5689 | 7326 |
| 16 | 66·4993 | 3207 | 39 | 53·8196 | 7493 |
| 17 | 66·1585 | 3408 | 40 | 53·0538 | 7658 |
| 18 | 65·7976 | 3609 | 41 | 52·2718 | 7820 |
| 19 | 65·4168 | 3808 | 42 | 51·4737 | 7981 |
| 20 | 65·0160 | 4008 | 43 | 50·6600 | 8137 |
| 21 | 64·5956 | 4204 | 44 | 49·8307 | 8293 |
| 22 | 64·1556 | 4400 | 45 | 48·9861 | 8446 |
| 23 | 63·6960 | 4596 | 46 | 48·1265 | 8596 |

(B.)—TABLE GIVING THE LINEAL VALUE IN MILES OF A DEGREE OF ARC MEASURED ALONG THE MERIDIAN.

| Mean Latitude. | Meridional Degrees in Miles. | Difference. | Mean Latitude. | Meridional Degrees in Miles. | Difference. |
|---|---|---|---|---|---|
| ° | | + | ° | | + |
| 0 | 68·7027 | 2 | 23 | 68·8072 | 88 |
| 1 | 68·7029 | 6 | 24 | 68·8160 | 90 |
| 2 | 68·7035 | 10 | 25 | 68·8250 | 93 |
| 3 | 68·7045 | 15 | 26 | 68·8343 | 96 |
| 4 | 68·7060 | 18 | 27 | 68·8439 | 98 |
| 5 | 68·7078 | 23 | 28 | 68·8537 | 101 |
| 6 | 68·7101 | 27 | 29 | 68·8638 | 102 |
| 7 | 68·7128 | 31 | 30 | 68·8740 | 105 |
| 8 | 68·7159 | 35 | 31 | 68·8845 | 107 |
| 9 | 68·7194 | 39 | 32 | 68·8952 | 109 |
| 10 | 68·7233 | 43 | 33 | 68·9061 | 110 |
| 11 | 68·7276 | 46 | 34 | 68·9171 | 112 |
| 12 | 68·7322 | 51 | 35 | 68·9283 | 114 |
| 13 | 68·7373 | 54 | 36 | 68·9397 | 114 |
| 14 | 68·7427 | 58 | 37 | 68·9511 | 117 |
| 15 | 68·7485 | 62 | 38 | 68·9628 | 117 |
| 16 | 68·7547 | 65 | 39 | 68·9745 | 117 |
| 17 | 68·7612 | 68 | 40 | 68·9862 | 120 |
| 18 | 68·7680 | 72 | 41 | 68·9982 | 119 |
| 19 | 68·7752 | 76 | 42 | 69·0101 | 119 |
| 20 | 68·7828 | 78 | 43 | 69·0220 | 121 |
| 21 | 68·7906 | 82 | 44 | 69·0341 | 120 |
| 22 | 68·7988 | 84 | 45 | 69·0461 | 120 |
| 23 | 68·8072 | | 46 | 69·0581 | |

(C.)—Table for constructing Graticules of Maps.—*Sides and Diagonals of Squares of one-fourth of a Degree of Latitude and Longitude, on the Scale of 1 Inch to 1 Mile.*

| Latitude. | Length in Inches. | | | |
|---|---|---|---|---|
| | *m* on Meridian. | *n* on Lower Parallel. | *p* on Upper Parallel. | *q* on Diagonal. |
| ° ′ ° ′ | | | | |
| From 0 0 to 0 15 | 17·176 | 17·290 | 17·290 | 24·371 |
| 0 15 ,, 0 30 | 176 | 290 | 290 | 371 |
| 0 30 ,, 0 45 | 176 | 290 | 289 | 371 |
| 0 45 ,, 1 0 | 176 | 289 | 288 | 370 |
| 1 0 ,, 1 15 | 176 | 288 | 286 | 369 |
| 1 15 ,, 1 30 | 176 | 286 | 285 | 368 |
| 1 30 ,, 1 45 | 176 | 285 | 282 | 367 |
| 1 45 ,, 2 0 | 176 | 282 | 280 | 365 |
| 2 0 ,, 2 15 | 17·176 | 17·280 | 17·277 | 24·363 |
| 2 15 ,, 2 30 | 176 | 277 | 274 | 361 |
| 2 30 ,, 2 45 | 176 | 274 | 271 | 359 |
| 2 45 ,, 3 0 | 176 | 271 | 267 | 356 |
| 3 0 ,, 3 15 | 176 | 267 | 263 | 354 |
| 3 15 ,, 3 30 | 176 | 263 | 258 | 351 |
| 3 30 ,, 3 45 | 176 | 258 | 254 | 347 |
| 3 45 ,, 4 0 | 176 | 254 | 249 | 344 |
| 4 0 ,, 4 15 | 17·177 | 17·249 | 17·243 | 24·340 |
| 4 15 ,, 4 30 | 177 | 243 | 237 | 337 |
| 4 30 ,, 4 45 | 177 | 237 | 231 | 332 |
| 4 45 ,, 5 0 | 177 | 231 | 225 | 328 |
| 5 0 ,, 5 15 | 177 | 225 | 218 | 323 |
| 5 15 ,, 5 30 | 177 | 218 | 211 | 318 |
| 5 30 ,, 5 45 | 177 | 211 | 204 | 314 |
| 5 45 ,, 6 0 | 177 | 204 | 196 | 308 |
| 6 0 ,, 6 15 | 17·178 | 17·196 | 17·188 | 24·303 |
| 6 15 ,, 6 30 | 178 | 188 | 180 | 298 |
| 6 30 ,, 6 45 | 178 | 180 | 171 | 292 |
| 6 45 ,, 7 0 | 178 | 171 | 162 | 285 |
| 7 0 ,, 7 15 | 178 | 162 | 153 | 279 |
| 7 15 ,, 7 30 | 179 | 153 | 143 | 273 |
| 7 30 ,, 7 45 | 179 | 143 | 134 | 266 |
| 7 45 ,, 8 0 | 179 | 134 | 123 | 259 |
| 8 0 ,, 8 15 | 17·179 | 17·123 | 17·113 | 24·252 |
| 8 15 ,, 8 30 | 179 | 113 | 102 | 244 |
| 8 30 ,, 8 45 | 180 | 102 | 091 | 237 |
| 8 45 ,, 9 0 | 180 | 091 | 079 | 229 |
| 9 0 ,, 9 15 | 180 | 079 | 067 | 221 |
| 9 15 ,, 9 30 | 180 | 067 | 055 | 212 |
| 9 30 ,, 9 45 | 180 | 055 | 042 | 204 |
| 9 45 ,, 10 0 | 181 | 042 | 029 | 195 |

(C.)—Table for constructing Graticules of Maps.—*Sides and Diagonals of Squares of one-fourth of a Degree of Latitude and Longitude, on the Scale of 1 Inch to 1 Mile.*

| Latitude. | Length in Inches. | | | |
|---|---|---|---|---|
| | *m* on Meridian. | *n* on Lower Parallel. | *p* on Upper Parallel. | *q* on Diagonal. |
| ° ′ ° ′ | | | | |
| From 10 0 to 10 15 | 17·181 | 17·029 | 17·016 | 24·186 |
| 10 15 ,, 10 30 | 181 | 016 | 003 | 177 |
| 10 30 ,, 10 45 | 182 | 003 | 16·989 | 168 |
| 10 45 ,, 11 0 | 182 | 16·989 | 975 | 159 |
| 11 0 ,, 11 15 | 182 | 975 | 960 | 148 |
| 11 15 ,, 11 30 | 182 | 960 | 946 | 138 |
| 11 30 ,, 11 45 | 183 | 946 | 930 | 128 |
| 11 45 ,, 12 0 | 183 | 930 | 915 | 118 |
| 12 0 ,, 12 15 | 17·183 | 16·915 | 16·899 | 24·107 |
| 12 15 ,, 12 30 | 184 | 899 | 883 | 097 |
| 12 30 ,, 12 45 | 184 | 883 | 867 | 085 |
| 12 45 ,, 13 0 | 184 | 867 | 850 | 073 |
| 13 0 ,, 13 15 | 185 | 850 | 833 | 062 |
| 13 15 ,, 13 30 | 185 | 833 | 816 | 050 |
| 13 30 ,, 13 45 | 185 | 816 | 798 | 037 |
| 13 45 ,, 14 0 | 186 | 798 | 780 | 026 |
| 14 0 ,, 14 15 | 17·186 | 16·780 | 16·762 | 24·013 |
| 14 15 ,, 14 30 | 186 | 762 | 743 | 000 |
| 14 30 ,, 14 45 | 187 | 743 | 724 | 23·988 |
| 14 45 ,, 15 0 | 187 | 724 | 705 | 974 |
| 15 0 ,, 15 15 | 187 | 705 | 685 | 961 |
| 15 15 ,, 15 30 | 188 | 685 | 666 | 948 |
| 15 30 ,, 15 45 | 188 | 666 | 645 | 934 |
| 15 45 ,, 16 0 | 188 | 645 | 625 | 920 |
| 16 0 ,, 16 15 | 17·189 | 16·625 | 16·604 | 23·906 |
| 16 15 ,, 16 30 | 189 | 604 | 583 | 892 |
| 16 30 ,, 16 45 | 190 | 583 | 561 | 877 |
| 16 45 ,, 17 0 | 190 | 561 | 540 | 862 |
| 17 0 ,, 17 15 | 191 | 540 | 518 | 848 |
| 17 15 ,, 17 30 | 191 | 518 | 495 | 833 |
| 17 30 ,, 17 45 | 191 | 495 | 472 | 817 |
| 17 45 ,, 18 0 | 192 | 472 | 449 | 801 |
| 18 0 ,, 18 15 | 17·192 | 16·449 | 16·426 | 23·786 |
| 18 15 ,, 18 30 | 193 | 426 | 402 | 770 |
| 18 30 ,, 18 45 | 193 | 402 | 378 | 754 |
| 18 45 ,, 19 0 | 194 | 378 | 354 | 738 |
| 19 0 ,, 19 15 | 194 | 354 | 330 | 721 |
| 19 15 ,, 19 30 | 195 | 330 | 305 | 705 |
| 19 30 ,, 19 45 | 195 | 305 | 280 | 688 |
| 19 45 ,, 20 0 | 195 | 280 | 254 | 670 |

(C).—Table for constructing Graticules of Maps.—*Sides and Diagonals of Squares of one-fourth of a Degree of Latitude and Longitude, on the Scale of 1 Inch to 1 Mile.*

| Latitude. | Length in Inches. | | | |
|---|---|---|---|---|
| | $m$ on Meridian. | $n$ on Lower Parallel. | $p$ on Upper Parallel. | $q$ on Diagonal. |
| ° ′ ° ′ | | | | |
| From 20 0 to 20 15 | 17·196 | 16·254 | 16·228 | 23·653 |
| 20 15 ,, 20 30 | 196 | 228 | 202 | 635 |
| 20 30 ,, 20 45 | 197 | 202 | 176 | 618 |
| 20 45 ,, 21 0 | 197 | 176 | 149 | 600 |
| 21 0 ,, 21 15 | 198 | 149 | 122 | 582 |
| 21 15 ,, 21 30 | 198 | 122 | 095 | 564 |
| 21 30 ,, 21 45 | 199 | 095 | 067 | 546 |
| 21 45 ,, 22 0 | 199 | 067 | 039 | 527 |
| 22 0 ,, 22 15 | 17·200 | 16·039 | 16·011 | 23·508 |
| 22 15 ,, 22 30 | 201 | 011 | 15·982 | 490 |
| 22 30 ,, 22 45 | 201 | 15·982 | 953 | 470 |
| 22 45 ,, 23 0 | 202 | 953 | 924 | 451 |
| 23 0 ,, 23 15 | 202 | 924 | 895 | 431 |
| 23 15 ,, 23 30 | 203 | 895 | 865 | 412 |
| 23 30 ,, 23 45 | 203 | 865 | 853 | 392 |
| 23 45 ,, 24 0 | 204 | 835 | 804 | 372 |
| 24 0 ,, 24 15 | 17·204 | 15·804 | 15·774 | 23·351 |
| 24 15 ,, 24 30 | 205 | 774 | 743 | 331 |
| 24 30 ,, 24 45 | 205 | 743 | 711 | 310 |
| 24 45 ,, 25 0 | 206 | 711 | 680 | 289 |
| 25 0 ,, 25 15 | 207 | 680 | 648 | 269 |
| 25 15 ,, 25 30 | 207 | 648 | 616 | 247 |
| 25 30 ,, 25 45 | 208 | 616 | 583 | 226 |
| 25 45 ,, 26 0 | 208 | 583 | 550 | 204 |
| 26 0 ,, 26 15 | 17·209 | 15·550 | 15·517 | 23·183 |
| 26 15 ,, 26 30 | 209 | 517 | 484 | 161 |
| 26 30 ,, 26 45 | 210 | 484 | 450 | 139 |
| 26 45 ,, 27 0 | 211 | 450 | 416 | 117 |
| 27 0 ,, 27 15 | 211 | 416 | 382 | 094 |
| 27 15 ,, 27 30 | 212 | 382 | 348 | 072 |
| 27 30 ,, 27 45 | 213 | 348 | 313 | 050 |
| 27 45 ,, 28 0 | 213 | 313 | 278 | 027 |
| 28 0 ,, 28 15 | 17·214 | 15·278 | 15·242 | 23·004 |
| 28 15 ,, 28 30 | 214 | 242 | 207 | 22·981 |
| 28 30 ,, 28 45 | 215 | 207 | 171 | 958 |
| 28 45 ,, 29 0 | 216 | 171 | 134 | 934 |
| 29 0 ,, 29 15 | 216 | 134 | 098 | 910 |
| 29 15 ,, 29 30 | 217 | 098 | 061 | 887 |
| 29 30 ,, 29 45 | 218 | 061 | 024 | 863 |
| 29 45 ,, 30 0 | 218 | 024 | 14·986 | 839 |

(C.)—TABLE FOR CONSTRUCTING GRATICULES OF MAPS.—*Sides and Diagonals of Squares of one-fourth of a Degree of Latitude and Longitude, on the Scale of 1 Inch to 1 Mile.*

| Latitude. | Length in Inches. | | | |
|---|---|---|---|---|
| | *m* on Meridian. | *n* on Lower Parallel. | *p* on Upper Parallel. | *q* on Diagonal. |
| ° ′ ° ′ | | | | |
| From 30 0 to 30 15 | 17·219 | 14·986 | 14·949 | 22·815 |
| 30 15 „ 30 30 | 219 | 949 | 911 | 790 |
| 30 30 „ 30 45 | 220 | 911 | 872 | 766 |
| 30 45 „ 31 0 | 221 | 872 | 834 | 741 |
| 31 0 „ 31 15 | 221 | 834 | 795 | 716 |
| 31 15 „ 31 30 | 222 | 795 | 756 | 692 |
| 31 30 „ 31 45 | 223 | 756 | 716 | 667 |
| 31 45 „ 32 0 | 223 | 716 | 677 | 641 |
| 32 0 „ 32 15 | 17·224 | 14·677 | 14·637 | 22·616 |
| 32 15 „ 32 30 | 225 | 637 | 597 | 591 |
| 32 30 „ 32 45 | 226 | 597 | 556 | 566 |
| 32 45 „ 33 0 | 226 | 556 | 515 | 539 |
| 33 0 „ 33 15 | 227 | 515 | 474 | 514 |
| 33 15 „ 33 30 | 228 | 474 | 433 | 488 |
| 33 30 „ 33 45 | 228 | 433 | 391 | 461 |
| 33 45 „ 34 0 | 229 | 391 | 349 | 435 |
| 34 0 „ 34 15 | 17·230 | 14·349 | 14·307 | 22·409 |
| 34 15 „ 34 30 | 230 | 307 | 265 | 382 |
| 34 30 „ 34 45 | 231 | 265 | 222 | 356 |
| 34 45 „ 35 0 | 232 | 222 | 179 | 329 |
| 35 0 „ 35 15 | 232 | 179 | 136 | 302 |
| 35 15 „ 35 30 | 233 | 136 | 092 | 275 |
| 35 30 „ 35 45 | 234 | 092 | 048 | 248 |
| 35 45 „ 36 0 | 235 | 048 | 004 | 221 |
| 36 0 „ 36 15 | 17·235 | 14·004 | 13·960 | 22·194 |
| 36 15 „ 36 30 | 236 | 13·960 | 915 | 166 |
| 36 30 „ 36 45 | 237 | 915 | 871 | 139 |
| 36 45 „ 37 0 | 237 | 871 | 825 | 111 |
| 37 0 „ 37 15 | 238 | 825 | 780 | 083 |
| 37 15 „ 37 30 | 239 | 780 | 734 | 055 |
| 37 30 „ 37 45 | 240 | 734 | 688 | 027 |
| 37 45 „ 38 0 | 240 | 688 | 642 | 21·999 |
| 38 0 „ 38 15 | 17·241 | 13·642 | 13·596 | 21·971 |
| 38 15 „ 38 30 | 242 | 596 | 549 | 943 |
| 38 30 „ 38 45 | 243 | 549 | 502 | 915 |
| 38 45 „ 39 0 | 243 | 502 | 455 | 886 |
| 39 0 „ 39 15 | 244 | 455 | 407 | 858 |
| 39 15 „ 39 30 | 245 | 407 | 360 | 829 |
| 39 30 „ 39 45 | 245 | 360 | 312 | 800 |
| 39 45 „ 40 0 | 246 | 312 | 263 | 771 |

*Note:*—This Table can be utilised for any other scale by simple proportion.

## SCALES OF MAPS.

(1) When the scale is one or more inches to the geographical mile, divide 72,996 (which is the number of inches in a geographical mile) by the scale, and the result will be the natural scale of the map, or the true proportion that a geographical mile on the map bears to a geographical mile on the earth's surface.

(Example) Scale 4 inches to the geographical mile:

$$\begin{array}{r} 4)72996 \\ \hline \underline{18249} \end{array} = \frac{1}{18249} \text{ nat. scale}$$

(2) When the scale is less than one inch to the geographical mile, multiply the number of inches in a geographical mile by the scale, and the result will be the natural scale of the map.

(Example) 5 geographical miles to one inch;

$$\begin{array}{r} 72996 \\ 5 \\ \hline \underline{364980} \end{array} = \frac{1}{364980} \text{ nat. scale}$$

(3) When a natural scale is given, the denominator of which is less than 72,996, and it is required to find the scale in inches, divide 72,996 by the denominator of the natural scale, and the result will be the scale of inches to a geographical mile.

Example $\frac{1}{18249} = 72{,}996 \div 18{,}249 = 4$ inches to a geographical mile, the scale of the map.

(4) When the denominator of the natural scale is greater than 72,996, divide the denominator of the natural scale by 72,996, and the result will be the scale in geographical miles to one inch.

Example $\frac{1}{364980} = 364{,}980 \div 72996 = 5$ geographical miles to one inch, the scale of the map.

For all practical purposes these rules are sufficiently exact, but, owing to the slight variation of the length of the degree latitude, it is not absolutely correct for all latitudes. Should it be required to get the scale in statute miles to the inch, it will only be necessary to substitute 63,360 for 72,996, and the same rules will then apply.

# PART III.

## SURVEYING.

### Mapping a Country.

The surveys that are mostly possible for travellers are route surveys, *i.e.*, laying down as much of a country as comes within the ken of a traveller on his line of march. Such surveys, if of any extent, must be assisted by astronomical observations to prevent the accumulation of errors. (*See* pp. 82, 135.)

Route surveying can be accomplished in several ways, but in any case is not an easy task for one who has no experience of ordinary surveying, as, to be successful, it requires a knowledge of how to make the most of opportunities, of which method is applicable, and generally a mastery of the various dodges by which alone an irregular survey can be made to give a result fairly approximating to the truth.

The principle underlying all surveying is to start from a base line of known length, and by means of angles or bearings to obtain rays to conspicuous objects from both ends, by the intersection of which their position can be fixed. Details are sketched in between.

The base line may be long or short, may be measured, either accurately, by means of a tape, cord, chain, etc., by astronomical observations, by triangulation in the manner shown, pp. 90, 120, 121, or, roughly, by estimation of the distance walked in a straight line.

Tacheometer surveying is a method in which an extremely short base is used, the angle subtended by it at a point at right angles to the centre of the base being measured from the point to be fixed; in this case not at a great distance from the base.

To aid the traveller, descriptions will be given of:—

The scale of the intended survey is an important point.

This will vary much with circumstances, but the limits of scale for ordinary route surveys may be roughly stated as from half an inch to one-tenth of an inch to the geographical mile.

The geographical mile should be chosen, as it facilitates the introduction of astronomical positions from time to time.

While parts which seem to require more detail may be mapped on a larger scale, and reduced into the general map, it will ordinarily be found that a scale of five geographical miles to an inch will be the most convenient.

It is above all things necessary that a traveller should state distinctly how his map has been made, the bases used, the instruments employed, and generally all information that will enable the map compiler to judge of the value of the work. The compiler has in most cases to fit the new work into old, and without some information which enables him to appraise the value of both, he is at a loss what to do when discrepancies, which are unavoidable in such work, occur.

Some portions of a route map are certain to be less accurate than others, and the traveller should append remarks on this head, because the object of all travellers surveying is to add to correct mapping, and not to displace previous work by the new, without regard to the accuracy which may attach to it.

Any work incorporated from a previous map should be distinguished in some way to avoid confusion, and if such work has been altered to fit the explorer's positions, it should be stated.

### *Route Survey with Prismatic Compass, Boiling-point Thermometer, and Aneroid.*

For the purpose of illustration, suppose the following to be an extract from a traveller's journal:—

*June* 1*st.*—Camp at the foot of hill A, and $2\frac{3}{4}$ miles distant from its summit, the magnetic bearing of which was 146°.

To measure the height of the hill A, above the camp, I read the aneroid and thermometer, first at camp and then on its summit, with the following results:—At camp, aneroid, 25·67 inches; temperature in

the shade, 70° Fahr.; at the summit of the hill, aneroid, 24·25 inches; temperature in the shade, 65° Fahr. At the summit of hill A, I took the following bearings, and a rough sketch of the country to the north, marking all prominent objects with a letter corresponding to the letter given to the bearing.

Bearings taken at A: G 351° 30′; F 340°; E 326°; D 308°; C 300°; B 283°. All bearings magnetic.

*June 2nd*, 8 A.M.—Aneroid, 25·7 inches; temperature in shade 78° Fahr. Struck camp, and travelled in a direct line towards hill marked E in the sketch, and at a distance, which I estimated to be fifteen geographical miles, we arrived at the right bank of a river, where we camped for the night. The country over which we have passed this day is destitute of trees, sandy, with patches of grass here and there, and gradually slopes downwards from our last camp to our present position. 6 P.M.: aneroid, 25·98 inches; temperature in the shade, 68° Fahr.; took the following bearings:—

Bearings taken at camp, 2, by river: D 270°; B 204°; A 146°; G 100°; F 8°. All bearings magnetic.

*June 3rd*, 8 A.M.—Aneroid, 26·05 inches; temperature in shade, 78° Fahr. Struck camp, and forded the river, which, after winding in an easterly direction from the hill, marked D in the sketch, to a point one and a half miles N.E. by E. of the ford, takes a bend to the S.E., passing to the west of the hill marked G on the sketch. At a distance of one mile below the ford, a large stream from the north flows into the river. Continued to travel in the direction of E, and at noon found that we had arrived at a point where C and F and our position were in one line of bearing—81° and 261° magnetic. During our halt, boiled a thermometer and read the aneroid, with the following results: water boiled at 204·3°; aneroid, 25·62 inches; temperature in the shade, 71° Fahr. 3 P.M. Resumed our journey, and at 6·30 P.M. reached the summit of the hill E, where we camped; estimated distance travelled, nineteen geographical miles. Aneroid, 24·60 inches; water boiled at 202·3°; temperature in the shade, 64° Fahr. Since leaving camp this morning, the country through which we passed was covered with vegetation, and we had the large stream to the right of us throughout the day. From this hill, E, we can see that the river we forded this morning takes its rise in the range of hills to the west of our present position, and flows with a wind-

ing course through the valley at the foot of the hill D, and so past our last camping-ground.

Bearings taken at E: C 236° 30′, and southern end of summit of same range, H 215°; D 174°; B 168°; A 146°; G 133°; F 118° 30′. All bearings magnetic.

*June 4th*, 8 A.M.—Aneroid, 24·65 inches; temperature in shade, 66° Fahr. Set out in a N.W. direction, and having no prominent object in view on the line of march, I noticed the direction in which my shadow was cast, and by this means, allowing for the sun's apparent motion, I avoided making any general deviation from the direction in which I wished to travel. Arriving at a small lake, we camped, having come an estimated distance of twelve geographical miles. Fixed the position of the lake by bearings of C and E.* Aneroid, 25·50 inches; temperature in shade, 70° Fahr.

Bearings taken at camp, near lake: C 195° 30′; H 185° 30′; E 113° 30′. All bearings magnetic.

*To Plot the Bearings*:—This can be done either on the true or magnetic meridian. The bearings being magnetic, it saves much trouble, and also chances of errors, to plot them from the magnetic meridian.

Through the station A draw with a pencil a line to represent the magnetic meridian in a direction convenient for the route. Place the protractor with its centre mark on A, and the 360° on the magnetic line, and set off the bearings observed.

The second camp being in the direction of hill E, measure 15 miles, on the scale adopted, on the line drawn toward E, which will give the position of Camp 2.

From this position lay off the bearings obtained, in a similar manner, having first drawn a magnetic meridian through it parallel to the first. The intersection of two lines of bearings of any one point, as taken from two different stations, will fix the position of that point with reference to the stations. If the true meridian is used, the procedure is the same, but each bearing must be corrected for the variation before laying-off, which can be approximately ascertained from the variation map facing p. 82. The line drawn through A will then represent the true meridian. In

* Take 180° from C for its opposite bearing. Add 180° to E for its opposite bearing.

both cases it should be stated on the map whether the meridian is true or magnetic.

Each station where bearings are taken must be plotted in a similar manner to Camp 2, that is, by bearing from the last station, and by estimated distance. Having by means of the first two stations fixed hills off the line of march, bearings of these will assist to obtain the position of the third, and so on. When no object can be seen to march for, the direction must be obtained by compass bearing of the line of march obtained from time to time.

The aneroid readings, and the boiling-point, furnish us with the means of ascertaining approximately the difference in height of two stations, which may be computed by the tables (*see* pp. 210 to 213, 217, 218), or, where the height is not considerable, by a simple arithmetical process as follows:—

Take the sum and difference of the aneroid readings, at the upper and lower station, get the mean of the temperature in the shade at the two stations. Then, sum of readings: difference of readings : : 55,000: the difference in height. Increase the result thus found by $\frac{1}{435}$ of itself for every degree that the mean temperature in the shade at the two stations exceeds 55°; subtract the like amount if it is below 55°. The aneroid readings, in the example, computed by the tables and this formula, will show a fairly close agreement.

| | Approximate Method. Feet. | By Tables. Feet. |
|---|---|---|
| A, above Camp 1 | 1608·5 | 1603·8 |
| 1st Camp above 2nd Camp | 310 | 308·8 |
| Foot of Range above 2nd Camp | 477·2 | 475·9 |
| Height of Range E | 1148·2 | 1145·0 |
| „ by Boiling point | | 1155·3 |
| E above Lake | 959·2 | 956·5 |

For plotting the work in the field, a scale of one inch to the geographical mile will exhibit all the main features of a country traversed in a day's journey. Special plans must be drawn on a scale suited to the area they are intended to represent; but whatever scale is chosen for the field work, it should be large enough to admit of considerable reduction in the fair plan, as by this process all errors are diminished. The projection of maps is purposely omitted here, as it is dealt with separately (*see* p. 58 *et seq.*); it will,

however, be of great assistance to the traveller if he provides himself with a blank map, on the scale of ten geographical miles to an inch, of sufficient range in latitude and longitude to include the country he intends to explore. He should also procure some paper ruled with dark lines into inch squares, and then again subdivided into five smaller squares; this will be useful to him for plotting his work in the field, and should be made up in the form of an ordinary sketching-block. Should the latitude and longitude of the point of departure be known, the latitude and longitude of any place on his route can be approximately determined by working the traverse. It must not, however, be supposed that an accurate survey of a large tract of country can be made with the aneroid, prismatic compass, and boiling-point thermometer; the most that a traveller could expect to do with the aid of these instruments would be to make a rough sketch of the country through which he passed. But instances are not wanting where travellers, by a judicious use of these simple instruments, have added very considerably to our geographical knowledge. The map of Schweinfurth's journey to the Welle is an example of what can be done with the material furnished by such observations.

The weak points in this method of surveying are, the errors caused by false estimates of the distance travelled, and those arising from the effects of local attraction on the compass. Knowing these sources of error, every care should be taken to guard against them. With regard to distance, the only safe way of estimating it is, by carefully noting the time occupied in passing from one place to another. In almost all countries bodies of men have a nearly uniform rate of progression, and by taking an early opportunity of noting this rate, the distance traversed in a known period of time can be fairly estimated. Schweinfurth, before setting out on his great journey to the Welle, carefully noted the time which it took him to pass over a known distance at a regular pace, to which he had trained himself; and truly wonderful results have been attained by native surveyors in India by following the same plan. The only precautions that can be taken against the effects of local attraction on the compass are, to be careful when taking a bearing to put all arms, such as rifles, at some distance from the compass; as a general rule, where possible, to avoid all rocks; and to take bearings both forward and backward on the route travelled, taking their mean as the magnetic

direction of the route. In a country thickly covered with forest it is most difficult to distinguish landmarks. The traveller may, however, sometimes leave a mark recognisable at some miles distance by giving a little consideration to it, and knowing the direction in which he is proceeding.

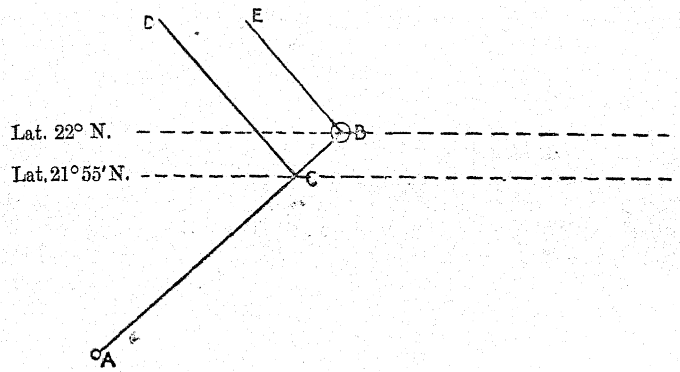
Enter every observation and change made in the general direction travelled, with the date and time, in the journal; as without attention to this, much valuable information may be lost. When preparing MS. to be sent home for publication, write each of the native names, *at least once*, in printing character. Numerous errors and great loss of time frequently result from the attempt to decipher proper names written by travellers in their ordinary handwriting only.

As has been stated, p. 80, the weak points in route surveying with prismatic compass are the errors caused by false estimates of the distance travelled, and those arising from the effects of local attraction on the compass. It is by no means easy to guard against these errors creeping in, and false estimates of distance are frequently brought about by the different nature of the surface of the country travelled over, as, for instance, when there is a change from firm open country to jungle or heavy sand, as the times occupied to traverse the same distance under these changed circumstances will differ considerably, and a time scale prepared for one will be useless for the other.

It is here that sextant observations become so valuable for correcting errors arising from the above sources, and even if a traveller has only a sufficient knowledge of its use to take the latitude, it will go far to increase the accuracy of his map, as the following diagram will show (p. 82).

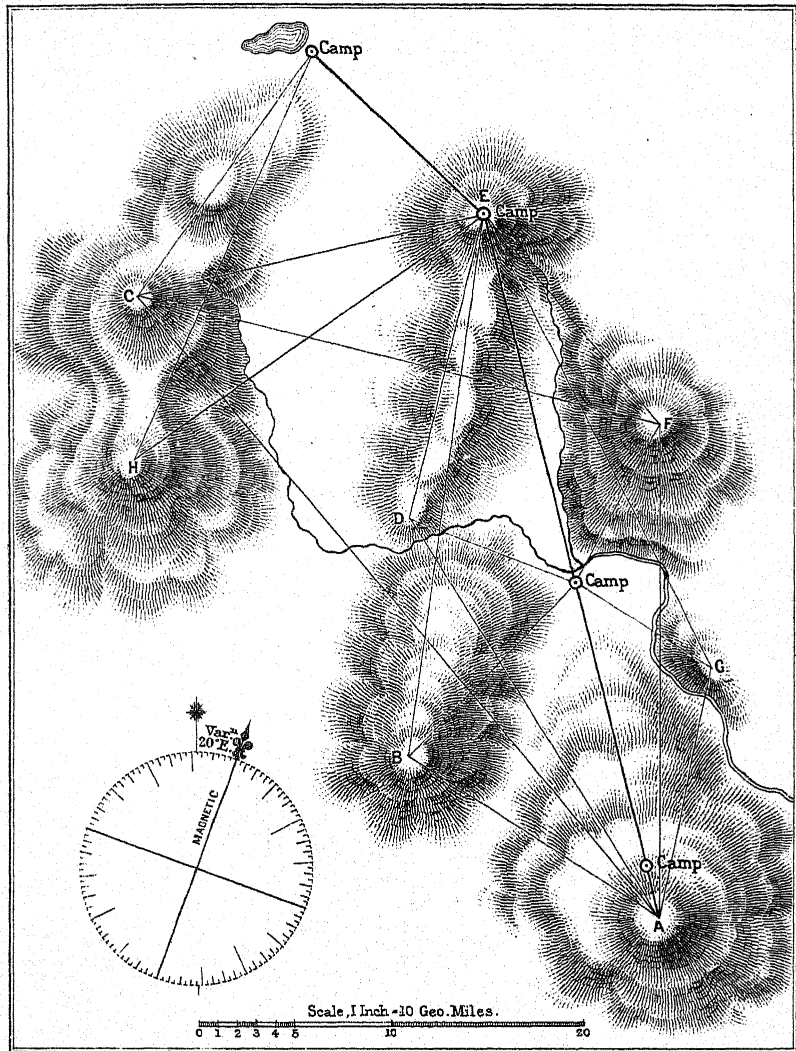
Suppose a person to travel from A to B in the direction A B, and that his estimated distance, by the scale of his map, places him at B in latitude 22° N., but when he observes the meridian altitude of a star he finds that his latitude is really 21° 55′ N., and that he has over-estimated his distance travelled by the distance C B, and that he really is at C and not at B. If this observation had not been taken he would have made B the point on his map to commence plotting his next day's journey, which would have led to considerable errors not only in his latitude and longitude, but also in the positions of the different points he fixed along his route, but by taking C as his starting point he not

only corrects his distance travelled, and his latitude, but also corrects his estimated position in longitude. When travelling nearly east or west these remarks would not apply, as the angle between his line of march and the parallel of latitude would be too acute, and his position




could only be corrected by such observations for latitude and longitude as are given in the portion of this book devoted to those subjects.

The bearings given in the journal have been laid down on the annexed map, corrected for 20° easterly variation, and will serve to illustrate the manner in which this portion of the work is done.



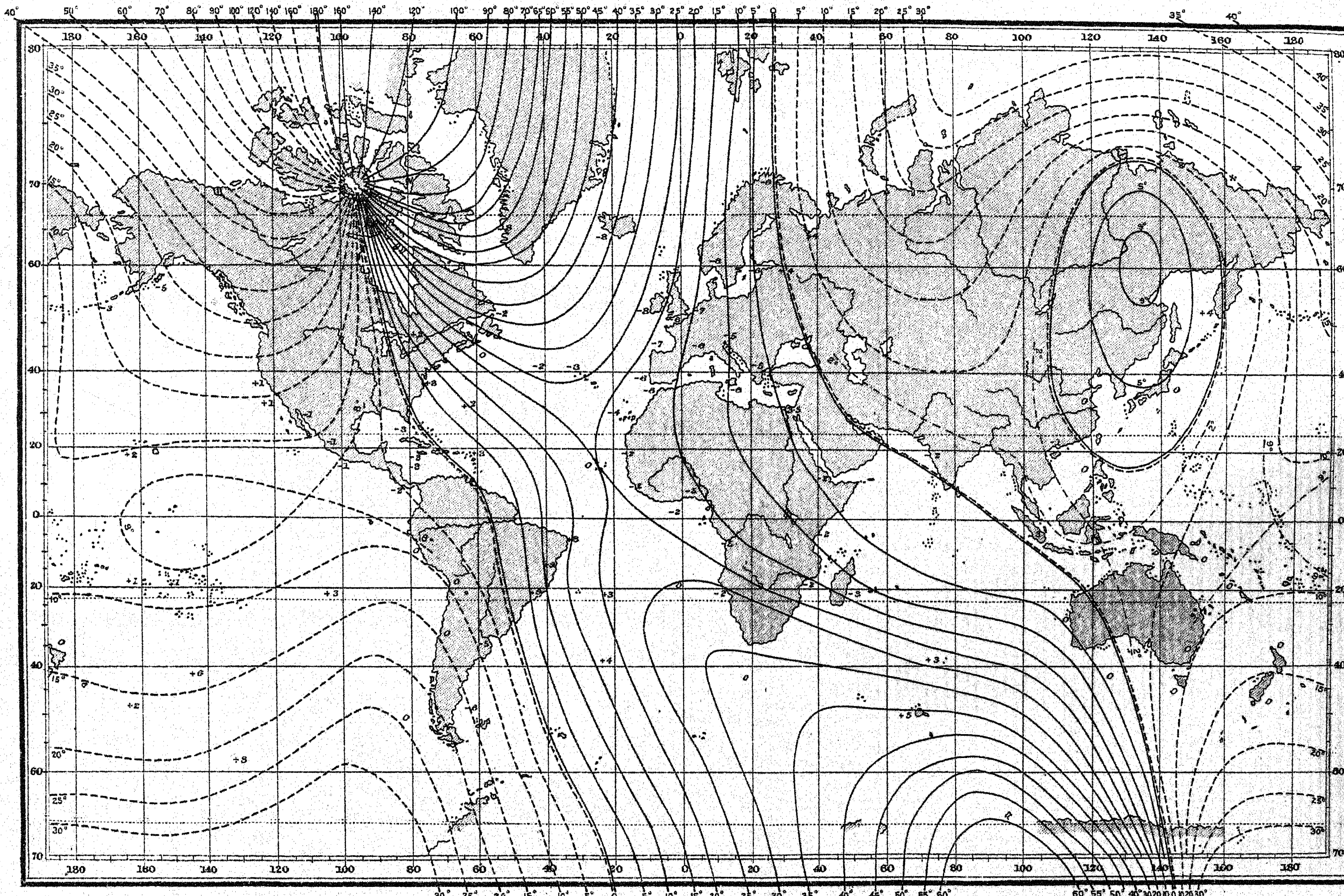

F.S.Weller

*Published by the Royal Geographical Society in "Hints to Travellers" 1906.*

# LINES OF EQUAL MAGNETIC VARIATION 1900

shewing also the

APPROXIMATE ANNUAL CHANGE IN MINUTES OF ARC.



——— Lines of West Variation
- - - - „ East „

*Published by the Royal Geographical Society in "Hints to Travellers," 1900.*

+ indicates an annual increase
− „ „ decrease

## Hints on Use of Sextant in Surveying.

*(For the description of this instrument,* *see p.* 15.)

*To measure the Angular Distance between two Terrestrial Objects.*

When the horizontal angles between terrestrial objects have to be taken with the sextant, the index is set to zero (0°), and the instrument must be held in the right hand in such a manner that its plane is parallel to an imaginary line joining the two objects; put back all the dark shades, and, looking through the telescope collar and the horizon glass at the *right* hand object, unclamp the index and move it slowly forward until the reflected image in the mirror of the horizon glass coincides with the other object seen directly; clamp the index and make the coincidence perfect with the tangent screw, then read the angle. Make it a rule to commence taking the angles from the object farthest to the right, then from the next farthest, and so on, always working from right to left. By so doing mistakes will often be prevented in plotting the work, and you will be able to recognise the objects from which angles have been measured in your rough sketch. Avoid very large or very small angles, as they may cause considerable errors in the positions assigned. Should it be required to measure the horizontal angle between two objects, one of which is at a considerable elevation above the other, as a tree on a plain and a mark on the top of a hill, it will be necessary to select some object immediately below the mark on the hill, and as nearly as possible on the same level as the tree, and measure the angle subtended by them. If no object in a suitable position can be seen, select some point about 90° or 100° from one of the objects, and observe the angles between each object and that point; the difference between these two angles will be the horizontal angle, nearly. Should the angle be too large to be taken in one measurement, the object to the right must be brought by reflection to some well-defined mark, and the reading taken; the angle must then be measured between the mark and the other object; the sum of these

readings, after the index error for each measurement has been applied, will be the angle required. Though the angles measured with the sextant are seldom, strictly speaking, the true horizontal angles, yet the errors arising from their obliquity are extremely small, if they have been well chosen, and indeed would be scarcely discernible, in work plotted with the ordinary protractor, which is only divided to 30′. A reference to the following diagrams will, it is hoped, make the previous remarks on this subject more clearly understood.

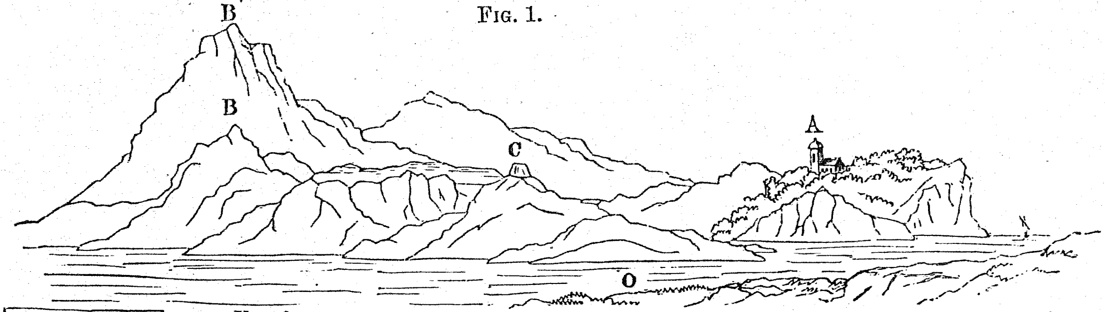
In Fig. 1 let A B be two objects, O the place of the observer; then the objects would appear in the horizon glass as shown in Fig. 2, when the angle was taken; A being seen in the mirror, B by direct vision through the unsilvered part. If the angle A O B had to be taken by two measurements, A O C would have to be taken first, and then the angle C O B; the sum of these two angles, which is the angle A O B, is the horizontal angle between A and B′, very nearly, because B is directly beneath B′, and is more nearly in the same horizontal plane as A. When a box sextant is used the reflected image is seen above the object by direct vision. In Fig. 3, if the horizontal angle between A and B had to be measured, select a point such as C, more than 90° from A, and at O, the place of the observer, take the angles A O C and B O C; the difference of these two angles will be more nearly the horizontal angle between A B at O, than the angle A O B.

TABLE FOR ASCERTAINING HEIGHTS AND DISTANCES BY THE SEXTANT.

| Mul. | Angle. | Angle. | Div. |
|---|---|---|---|
| | ° ′ | ° ′ | |
| 1 | 45 00 | 45 00 | 1 |
| 2 | 63 26 | 26 34 | 2 |
| 3 | 71 34 | 18 26 | 3 |
| 4 | 75 58 | 14 2 | 4 |
| 5 | 78 41 | 11 19 | 5 |
| 6 | 80 32 | 9 28 | 6 |
| 8 | 82 52 | 7 08 | 8 |
| 10 | 84 17 | 5 43 | 10 |

The sextant being set to any angle contained in the Table, any height or distance of accessible or inaccessible objects may be obtained, on level ground, in a very simple and expeditious manner. Make a mark

Fig. 1.



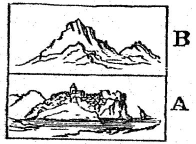
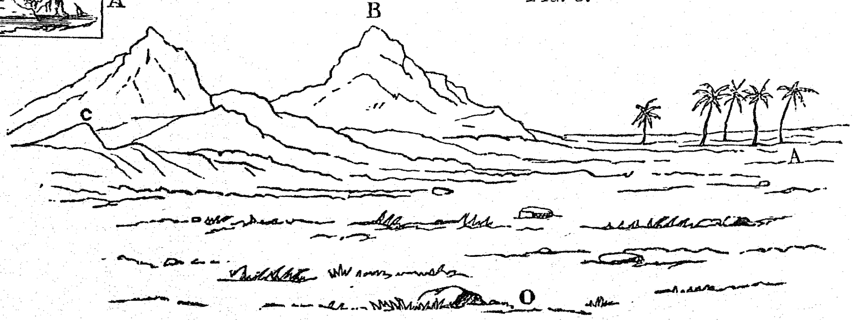




Fig. 2.

Fig. 3.



on the object, if accessible, equal to the height of the eye; set the index to one of the angles in the Table, and advance or go backwards from the object, until, by reflection, the top of the object is brought by the mirrors to coincide with the mark first made. If the angle be greater than 45°, multiply the distance to the object by the number in the next column to the angle in the Table; if the angle be less than 45°, divide, and the result will be the height of the object from the mark; to which add the height of the eye.

If the object is inaccessible, set the index to the greatest divisor angle in the Table that the least distance from the object will admit of; move backwards and forwards until the top of the object is reflected level with the eye; at this place set up a staff equal to the height of the eye. Then set the index to any of the lesser angles; go back in a line with the object, until the top is made to appear on the level with the top of the staff; fix here another mark; measure the distance between the two marks set up; divide this by the difference of the numbers corresponding to the angles made use of, and the quotient will be the height of the object from the top of the staff; to which add the height of the eye.

*For the distance.*—Multiply the height of the object by the numbers against either of the angles used, and the product will be the distance of the object from the place where such angle was used.

If the index is set at 45°, the distance is equal to the height, minus the height of the eye.

*At a given point to mark off a line perpendicular to any given direction.*—If this direction is not sufficiently distinguished by some natural object, such as a tree, mark it by a flag set up as far off as convenient; then, standing at the given point, with the sextant set to 90°, make a man, bearing a flag, stand in a line estimated as the perpendicular. Motion him right or left until his flag can be seen, by reflection, to coincide with the other. There let him fix his flag, so marking the direction of the perpendicular.

Of course any other direction can be marked in the same way, setting off the required angle on the sextant, instead of the 90°.

## Surveys with Sextant and Prismatic Compass.*

*By* General Sir C. W. Wilson, R.E., K.C.B.

A traveller who intends to devote a portion of his time to the survey of the country he is about to visit, should consider before leaving home what he is going to do, and how he will do it. The character of the proposed survey, the projection to which it is to be referred, the scale or scales to be adopted, the instruments to be used, should be carefully thought over before commencing work, and there should be no hesitation when once upon the ground. A decision on these points depends on various considerations—such as the time and means at the disposal of the traveller, the object in view, the nature and geographical position of the country, &c.; and the following notes are confined to a few hints which may be useful in the field.

*Projection.*—When the extent of country to be laid down is small, it may be treated as a plane-surface; but when it is considerable, allowance must be made for curvature, and some projection of a portion of the sphere, adopted. The projection should be selected with reference to the latitude and local peculiarities of the country to be surveyed; the sheet should be prepared before leaving home by a competent draughtsman, and two or more copies of each taken, packed in a round tin plan-case. It may happen, however, that a projection has to be made in the field, instruction for which will be found, p. 58 *et seq.*

*Scale.*—For the fair plan, a scale of 10 miles to an inch is recommended, for the field sketch or outdoor-work, a scale of 2 miles to the inch; or, if much detail is required, of 1 mile to the inch. The scale of 2 miles to the inch has this advantage—that the ordinary sketching-card 12″ × 15″ will contain sufficient ground—24 miles × 30 miles—for the day's work and most of the points to which bearings are taken.

The classes of *Survey* to which attention may be directed are—1. A

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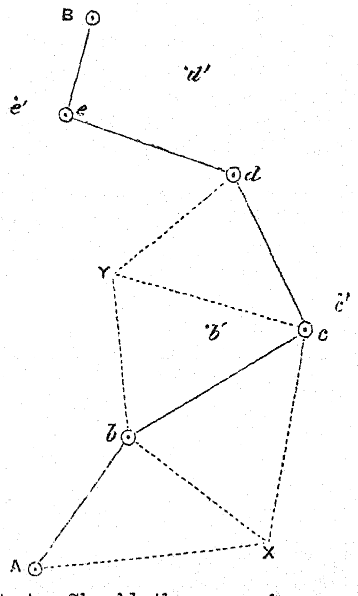
* It will be understood, that if a small theodolite can be carried, the work of surveying will be greatly facilitated.

simple route-survey; 2. A district-survey; 3. A special survey of a small tract of country; and 4. A survey of a plot of ground containing ruins, &c. The only instruments supposed to be available are—sextant, watch or chronometer, prismatic compass, measuring tape, aneroid, &c.

1. *Route Survey.*—Arrived on the ground, the traveller must first fix, with as much accuracy as possible, the position of some point on the earth's surface to which his work may be referred. If he starts from the coast-line, the position of some well-defined point can generally be obtained from the Admiralty Charts, but if no such resource is available, the position of his initial point must be determined by astronomical observations. The latitude can be obtained by a good observer with a 6-inch sextant to about 100 yards on the earth's surface; but the longitude is seldom found by lunar distances to within ten minutes (10 miles on the Equator). The position of the initial point, A, having been determined, work commences. The true bearing of some well-defined distant peak, or other landmark, is obtained, and this having been made "zero," a round of angles is taken with the sextant to conspicuous objects, some of which should be in the direction of the proposed line of march, and, if possible, near the first halting-place. Several observations of the zero-point are made with the compass, the needle being deflected each time, to obtain the variation, and the aneroid read for altitude. All angles should be booked at once in ink, and the names of the observed objects carefully noted; a rough outline-sketch of the peaks or other landmarks will be found useful in identifying points as the work proceeds. The initial point, A, is pricked off on the sketching-card in a suitable position for laying down the day's march, and surrounded by a circle ⊙; the observed angles are plotted; and a magnetic meridian is drawn; all is then ready for plotting the route. The compass is set up at A, and the sights of the instrument are directed on some object, $b'$, in the direction of the line of march; the bearing of $b'$ is read off and plotted from A on the field-sheet by means of the protractor; bearings are then taken to conspicuous objects such as X, which appear to lie near the line of march, and these are likewise plotted. The march now commences in the direction of A $b'$, and is continued to the point $b$, where the route is found to turn to the right; the distance A $b$, measured during the march, is laid down upon the field-sheet, and the point $b$, surrounded by a circle ⊙; the compass is then set up at $b$, and the bearing of an object, $c'$, in the direction of the new line of

march, read off and plotted from *b* on the field-sheet; bearings are also taken to objects, such as X, Y, on either side of the route, and plotted; the point X having also been observed from A, is now fixed. The march is again taken up in the direction *b c'* until a point *c* is reached, at which the road bends to the left, the distance *b c* laid down, and so on until camp B is reached. At B, observations should be made in the evening for time and latitude; and in the morning, observations similar to those which




have been made at A. Should the camp be near one of the points observed to from A, the distance and true bearing of such point from B should be determined, with a view of fixing its position. At certain camps the longitude should be found by lunar distances, or other methods, to serve as a check on the traverse-survey. Distances on the line of march may be measured by counting or timing the paces of a man, or by counting or timing the paces of a horse, mule, camel, &c., whose length of step is

known. Time-measurement will be found most convenient, and, with care, will give very good results. Compass bearings need only be taken at every second station on the line of march. Objects on either hand should, where possible, be fixed by three bearings. It is not desirable to take compass-bearings to points more than 6 or 7 miles distant, as the prismatic compass can seldom be depended upon to within one degree, and an error of this amount in 6 or 7 miles would give an error of ·05 inch on a scale of 2 miles to the inch. If the route runs near a peak, of which the true bearing has been determined from A, it should be ascended, and a round of angles taken with the sextant, making A the zero-point. When there is a mid-day halt, the meridian altitude of the sun should be observed. If a field-sketch cannot be kept up, the route should be entered in a field-book, and afterwards plotted, before details are forgotten. A book—with every alternate page ruled into squares by strong lines, and subdivided by finer lines, the smaller squares representing five minute intervals of time, the larger ones one hour—will be found of great use in making a rough sketch of the route; or a modification of the form used in booking a traverse-survey may be adopted. In all cases the bearings, distances, &c., should be clearly written in the book.

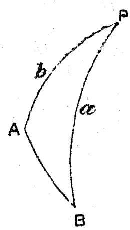
In this field-sketch the ground has been treated as a plane surface, and as soon as convenient the work should be transferred to the projection on the fair plan. In doing this it becomes necessary to calculate the latitudes and longitudes of the camps, and other points, from the material provided by the survey; when this has been done, the fixed points are laid down in their true positions on the map, and the detail reduced to the proper scale.

2. *District Survey.*—The basis of any survey of an extensive district should be a system of triangulation, and the first step is the measurement of a base line. With no instruments except a sextant, tape and prismatic compass, the best plan is to measure an astronomical base, and thence extend the triangulation as far as may be necessary. Two suitable points, A and B, lying nearly north and south of each other, are selected as the ends of the proposed base; the position of A on the earth's surface is determined at the point itself, the true bearing of B from A is obtained, and B having been made zero, a round of angles is taken with the sextant to conspicuous points; camp is then moved to the vicinity of B, and observations for latitude made at that point; the true bearing of A from B

is then obtained, and a round of angles taken to the points previously observed to from A. The length of the base A B can then be computed and the position of several of the points observed to from A and B determined. The fixed points are next laid down on the field-sheet, and the detail filled in with the prismatic compass. In this way the triangulation may be extended over the district to be surveyed, care being taken to check the work occasionally by observations for latitude at selected points.

The following notes and problems* will be found useful in constructing the map:—

*Problem I.*—Let A and B be two stations visible from one another, $AP=b$, $BP=a$, their observed co-latitudes; the angles A and B their




reciprocal true azimuths; and A P B, or P, the required angular difference of longitude. Then by spherical trigonometry—

$$\text{Cot. } \tfrac{1}{2} P = \frac{\cos. \tfrac{1}{2}(a+b)}{\cos. \tfrac{1}{2}(a-b)} \tan. \tfrac{1}{2}(A+B)$$

which determines P.

*Problem II.*—The latitude and longitude of any point being known, that of any other point within a short distance can be determined by plane trigonometry. Suppose the latitude and longitude of the camp at A to be known, whence that of a neighbouring peak or land-mark, C, is to be determined; the distance A C must be measured, and the azimuth N C A observed, then the difference of longitude AB is the sine of A C B to radius

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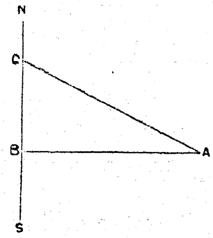
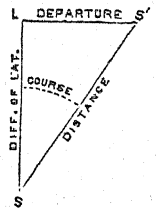
* Problems II.-V. are taken from Frome's 'Outline of a Trigonometrical Survey,' revised by Major-General Sir C. Warren, R.E.

AC, and the difference of latitude B C is the co-sine to the same angle and radius.

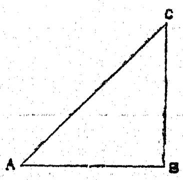



*Problem III.*—The distance between two places is generally resolved by plane trigonometry, the difference of latitude S L, and the azimuth, S′S L, called the *course*, forming a right-angled triangle, in which S S′, the *distance*, is determined: the other side L S′, termed *departure*, being the sum of all the meridional distances passed over.




*Problem IV.*—Given the distance travelled on a given parallel of latitude to find the difference of longitude.

Again, in the triangle A B C, let A B represent the distance or departure,

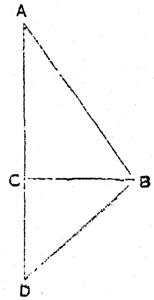


and the angles B A C be equal to the latitude, then A C, the hypothenuse, will be equal to the difference in the longitude.

*Problem V.*—Given the departure to find the difference of longitude.

Also, if D B represent the distance, and C D the difference of latitude, then B C D will be a right angle, and B C the departure, nearly equal to the meridian distance in the middle latitude. If, then, in the triangle A B C the angle A B C be measured by that middle latitude, A B, the hypothenuse will be nearly equal to the difference of longitude between D and B.

For the variation of the compass, it is convenient to take a bearing of the sun at sunset or sunrise; or, if this cannot be done, an azimuth of the sun at any time three hours before or after noon will answer equally

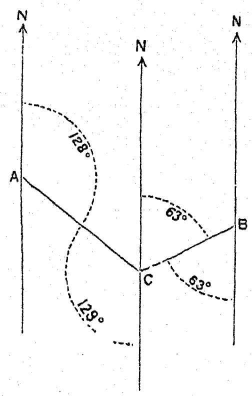



well. From the angular distance between the sun, when its own diameter is above the horizon, and any well-defined peak, measured with the sextant the true bearing can be obtained.

To find the sun's true amplitude for any day:—to the log-secant of the latitude, rejecting the index, add the log-sine of the sun's declination corrected for the time and place of observation. Their sum will be the log-sine of the true amplitude. If the true and magnetic amplitudes be both north or both south, their difference is the variation; but if one be north and the other south, their sum is the variation; and to know whether it be easterly or westerly, suppose the observer looking towards that point of the compass representing the magnetic amplitude; then, if the true amplitude be to the right hand of the magnetic, the variation is east, but if to the left hand, it is west.

In filling in a survey, the observer can fix his position, C, by observing two fixed points, A and B, and plotting from those points the opposite bearings to those observed; their intersection fixes the point required. The nearer the two bearings meet at a right angle the more correct will the point be determined, and, if a third fixed point is visible, a bearing to it will act as a check on the other.

A third and accurate method of fixing the position is by the angles subtended between three known objects. The instrument called the station-pointer is generally used for this purpose; but the position may also be found with a pair of compasses and protractor, or, more simply,

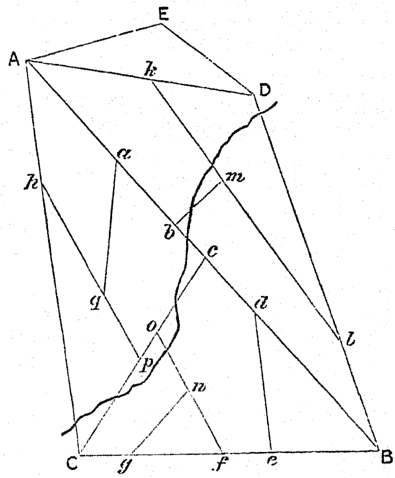



as follows, by means of a protractor and a sheet of tracing paper. Draw a line through the centre of the paper; place the protractor on it near to the bottom of the sheet; lay off the right-hand angle to the right, and the left-hand angle to the left of the centre-line; rule pencil-lines, radiating from the point over which the centre of the protractor has been placed, to the points that have been laid off; then place the paper on the plan or map, and move it about until the three lines coincide with the objects taken; prick through the point that lay beneath the centre of the protractor, and the observer's position is transferred to the plan. When possible, the centre object should be the nearest.

Any object whose true bearing is east or west must be in the same latitude as the place of the observer.

Any object whose true bearing is north or south must be in the same longitude as the observer.

3. *Special survey of a small tract of country,* with compass and tape only.—First walk over the ground and examine it, with a view to the selection of prominent points for stations, and of a level space for the




A B --Main line.
A B C } —Principal triangles.
A B D }
C c—Tie line.

measurement of a base. Having fixed upon a base, A B, set the compass up at A, and take a round of bearings to B and other selected stations, C, D, E, &c.; then mark A on the field-sheet, in such a position as will enable the whole sketch to go on the sheet, and protract the several bearings from it. Mark A on the ground with a pile of stones or staff, measure the base A B with the tape or by pacing, lay the distance down on the field-sheet to the adopted scale, set the compass up at B, and take

a round of bearings to A, C, D, E, &c. These bearings are now plotted, and their intersections with the bearings from A fix C, D, E, &c.; in this manner a rough triangulation is established, and a number of points fixed, by the aid of which the detail can be filled in.

The paper, or field-sheet, for sketching with a prismatic compass, should have parallel lines at unequal distances ruled upon it, to be considered as east and west lines.

4. *Survey of a plot of ground containing ruins, &c.*—In making a survey with a tape alone, we are confined to the simplest geometrical figure—the triangle, as it is the only one of which the form cannot be altered if the sides remain constant. In carrying out such a survey, divide the surface into a series of imaginary triangles, as large as the nature of the ground will admit of, and attend to the following rules:—

1. Do not be in a hurry to commence work, but walk over the ground, and make a rough eye-sketch of it on paper.

2. Select two points, as far apart as possible, visible from each other, and commanding a good view; let the points be near the boundaries of the ground, and so situated that the line joining them forms a sort of diagonal; this becomes the *main* line.

3. Select a point on each side of the main line, near the boundary of the work, to which lines can be measured from each end of it, thus giving two large triangles; then measure a check, or *tie* line, from one of the vertices to a point at, or near the middle of the opposite side.

4. On the sides of these triangles, erect smaller ones to embrace all the ground to be surveyed.

5. Measure lines from any station laid down, or from any part of a line connecting two of them in directions most convenient for obtaining the detail, taking offsets to such objects as present themselves.

The interiors of large buildings should be measured in a somewhat similar way, by dividing them into imaginary triangles, and measuring tie lines.

The great principle in all surveys is to work from a whole to the parts; errors are thus subdivided and time and labour economised.

The following symbols are recommended for adoption :—

| | | | |
|---|---|---|---|
| ∠'s signifies angles. | | | |
| △ a station in the triangulation. | | | |
| ⊖ | „ | fixed by latitude. | |
| ⦶ | „ | „ | longitude. |
| ⊕ | „ | „ | lat. and long. |
| ⌖ | „ | „ | true bearing. |
| >\| | „ | „ | right tangent. |
| \|< | „ | „ | left „ |

### Surveying with the Plane Table.

(*For a description of this instrument, see* p. 40.)

The first thing for the traveller to decide on, in commencing a survey, is the direction and extent of his base; and, as no special instructions can be given for a base suitable for all surveys, it is a matter in which he must exercise his own discretion, bearing in mind the following points: that the length of the base line should not be out of proportion to the distance of the points to be fixed, and that the first points to be fixed must be visible from both ends of the base line. The length of the base should be accurately measured, or determined by observation. The direction of the base line must depend on the positions of the points to be fixed, as, when the angles subtended are either too obtuse or too acute, a small error in the alignment will produce a large one in the survey.

Having decided on a base line, call it A B (Fig. 1, p. 98), set up the plane table over A, and arrange the board so that the direction of *a b* will suit the position of the first portion of the survey. Level it by moving the legs of the tripod, and using the circular level on the ruler. Clamp the table, and mark a point on the paper in any convenient position, to represent A on the ground, call this *a*. Stick a pin in at *a*, and, placing the fiducial edge of the ruler against this pin, turn the ruler about until the other end of the base, B, can be seen through the slit on one of the alidade sights, on the wire of the other sight, then draw a line along the fiducial edge

from *a* towards *b*, and take the distance from A to B with the compasses from the scale on which it has been decided to construct the map; set it off on the line just drawn, and mark it *b*; then *a b* on the board will represent the base line A B on the ground. Now set the sights in turn on the other points it is desired to fix, and, keeping the fiducial edge of the ruler against the pin at *a*, draw faint lines to each of them. To prevent mistakes, these lines, called "rays," should be marked with reference numbers indicating the object to which they are drawn, or the name of each object should be written against the line drawn to it. Having done this, place the compass on the table, and turn it about until the needle points exactly to the centre mark in the compass box, which will be

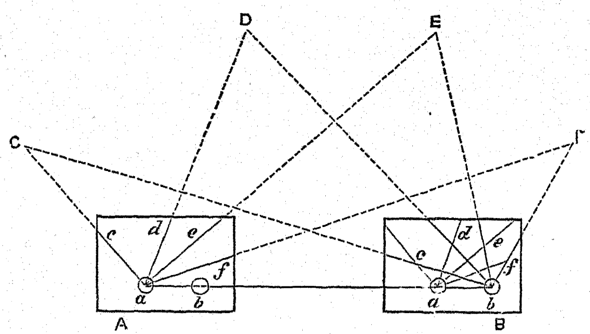



FIG. 1.

magnetic north, then draw a dark line upon the paper, along the edge of the compass box, which can be afterwards used for orienting the table as explained (p. 105).

Having drawn all the rays at station A, remove the table to station B, set it up and level it in the manner before described; then stick a pin at *b*, place the fiducial edge ot the ruler against it, and against *a*. Unclamp the table, and turn it about until the sights are directed on A, then clamp the table, and it will be in a position to continue the work. The process of pivoting the ruler against the pin, and directing the sights on the objects to be fixed, is to be repeated precisely in the same manner as at station A, and the points where the rays drawn from *b* intersect the

rays drawn from *a* will be the position of each object on the map. Fig. 1 (p. 98) illustrates the manner in which the work is done.

*To continue the survey by obtaining fresh rays to objects from another station.*—First orient the table correctly, and find the position of that station on the board.

By *orienting* is meant placing the table in such a position that the north and south line on it shall correspond with the magnetic north and south; or, what is the same thing, so that the line drawn between any two stations on the board shall be parallel to the line between the stations on the ground.

The position on the board of the station at which the board is set up can be found, and the board oriented in a variety of ways.

(1.) *When the station has been fixed by two rays from the ends of the base or from other stations*, all that has to be done is to place a pin in the board at the station mark, lay the fiducial edge of the ruler against it and against the mark on the board indicating the most distant station from which a ray has been drawn, turn the board until the sights are in a line with A, and clamp the board, which is then oriented.

(2.) *To find the position when only one ray has been drawn to the station*:—Set up the table over the station to be fixed, say D (Fig. 1, p. 98), and place the fiducial edge of the ruler along the ray that has been drawn, say *a*, *d*, turn the table until the sights align on A, clamp the table, which will then be oriented. Place a pin in at *b* on the table and turn the ruler about until it is aligned on B, and draw a line which will intersect the line already drawn at *d* on the table, the position required.

Repeating the last operation with other fixed stations will, if the lines intersect, give certainty to the new position.

It may be mentioned that it is always preferable to choose a station which has one ray already drawn to it, to fixing by any of the following methods.

(3.) *To find the position when no ray has been drawn to it, but with the fixed points on the board*, the following methods may be employed.

With three visible stations, A B C (Fig. 2, p. 100), represented on the table by *a b c*, the table can be oriented, and the position of an unknown point *x* found.

*First Method.*—In interpolation the surveyor should set up the plane-table at the desired spot, fixing it as level as possible. The compass

should then be placed accurately on the line previously drawn to indicate its position, as before described, and the plane-table turned round in azimuth until the needle points to 0°, and then clamped.

Three fixed points should then be selected from which to interpolate the position. The points should be as near as possible and chosen so that the observer is inside the triangle formed by joining the three points. The ruler is then laid on each point in succession and lines drawn along its edge. If the plane-table has been set up accurately in azimuth, the three rays will intersect in a point, which is the required position. More frequently, however, the intersections form a small triangle of error, in which case it is necessary to determine the true position.

First, where the observer's position is inside the triangle formed by joining the fixed points. In this case the true position will be within the small triangle of error formed by the intersection of the rays. It will also occupy such a position that its perpendicular distance from each ray will be in proportion to the distance of the observer's position from the respective trigonometrical points.

Thus in Fig. 2, *p* will be the correct position, the perpendicular distances *p a*, *p b*, *p c* being proportional respectively to *p* A, *p* B, *p* C.

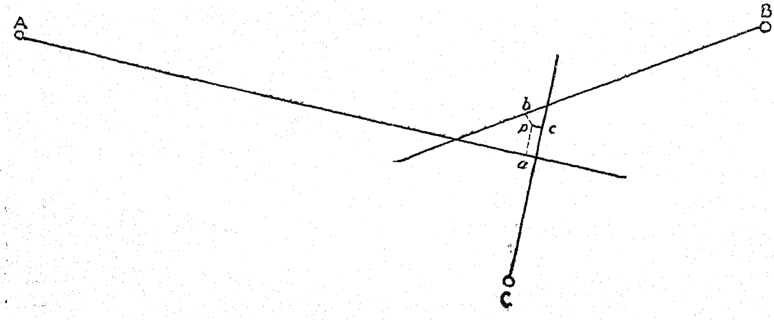



Fig. 2.

Secondly, where the observer has been forced to use three trigonometrical points so placed that his position lies outside the triangle formed

by joining them. In this case the point will lie outside the triangle of error.

The same condition holds that the distances of the point from the rays will be proportionate to the distances of the respective fixed points, but there is another condition which must be satisfied; that is, that the point must be so situated that all the rays have to move in the same direction round their respective fixed points in order to reach it, when the table is turned in azimuth.

Taking the second condition first, a glance at Fig. 3, p. 101, will show that there are only two possible positions of the fixing which fulfil it, *i.e.*,

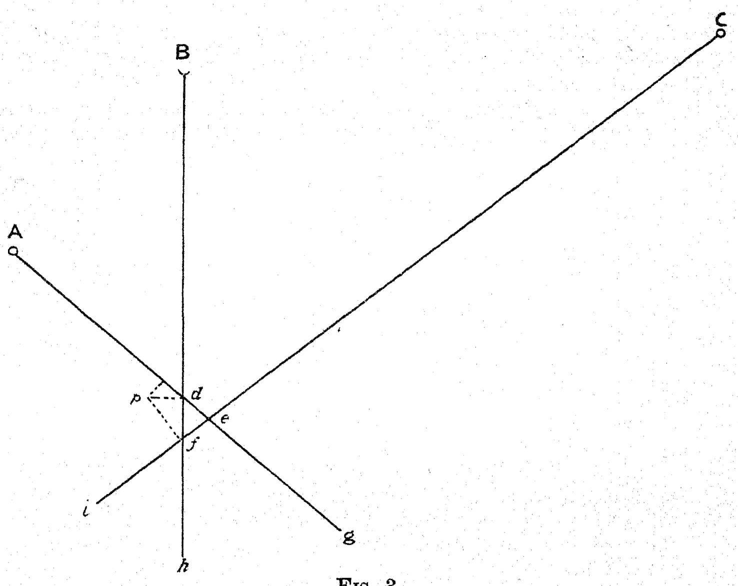



FIG. 3.

in the space C $e$ $g$, where all the rays would have to swing to the right or in the space A $d$ $f$ $i$, where they would all have to swing to the left.

Now the first condition of the relative distances will decide which

position is the correct one. It will be seen that there is no point in C *e g* which fulfils this condition, but in the space A *d f i* there is one point *p*, the perpendicular distances from which on to the rays A *g*, B *h*, and C *i* are proportional to the distances A *p*, B *p*, and C *p*. With a little practice, the position of this point can be estimated most accurately. In either case, having determined the approximate position of the point, lay the ruler over it and the most distant visible fixed point on the board, and turn the board in azimuth till that point is intersected and clamp it. The interpolation should then be repeated, when, if the point has been properly chosen, the rays will intersect on it; if any small error still remains, the process should be repeated. The rule of setting in azimuth by a distant point is one which should always be borne in mind, or the effects of errors in laying the rule over the points and in the accuracy of the assumed position are much minimized.

*Second Method.*—Fix a pin in the point *b* on the plane table (Fig. 4, p. 102), and placing the ruler against it and the point *a*, with the object and sight

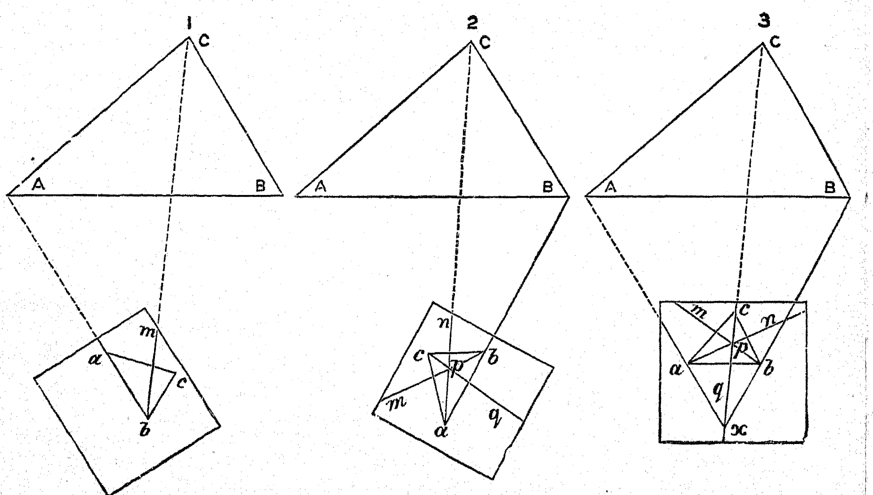



FIG. 4.

towards *a*, turn the table about until the point A is intersected; then, clamping the table in this position, turn the ruler and intersect the point C, with the edge of the ruler still against the pin at *b*, and draw the line *b m*:—Now remove the pin to the point *a*, and unclamp the table, place the ruler against the pin at *a*, and the point *b*, and turn about the table until the point B is intersected (*vide* 2); clamp the table again, and, having intersected the point C as before, draw the line *a n*. Through the intersection *p* of the lines *a n* and *b m*, draw the line *c p q* passing through the point *c*, and, placing the edge of the ruler against this line, unclamp the table once more, and turn it about until the point C is intersected (*vide* 3); now clamp the table, and it will be oriented, and the unknown point *x* will be situated on the line *c p q*; to find this point it is merely necessary to place the pin at *a*, and intersect the point A; draw the line A *a x*. The accuracy of the operation is tested by intersecting the other point B in the same manner, and drawing the line B *b x*, which should intersect the line A *a x* on the line *c p q*, thus giving the position of *x* on this line.

When the point *c*, with regard to the point *x*, is situated on the other side of the line A B or below it, the lines *a n* and *b m* will intersect on the opposite side of the line *a b*, to that on which *c* is, and, if the point *x* be situated within the triangle A B C, these lines (*a n* and *b m*) will diverge instead of converge, in which case they must be prolonged in the opposite direction until they intersect for the point *p*. The accuracy of this result depends upon the length of the line *c p*.

*Third Method.*—Fasten a piece of tracing paper over the survey with drawing-pins, stick a pin in at any point *x* on the table (Fig. 5, p. 104), place the fiducial edge of the ruler against it and point the sights in turn on the stations A B C, on the ground, represented by *a b c* on the plan, drawing lines towards you on each occasion until they meet at *x*. Now take out the pins that fasten the tracing paper to the board, and shift it about until each of the lines passes through its corresponding station, as shown on Fig. 5. Prick through *x*, which will be your position on the plan.

In using this method, however, care must be taken to select objects placed so that the centre one shall be the nearer, or the position found may be considerably in error.

For example, a position obtained by this method from objects as in Fig. 6, p. 104, would be of little value, as $x$ on the tracing paper could be

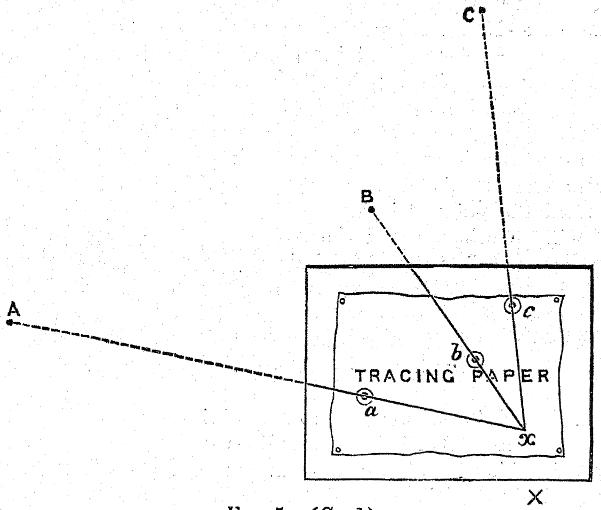



Fig. 5.—(*Good.*)

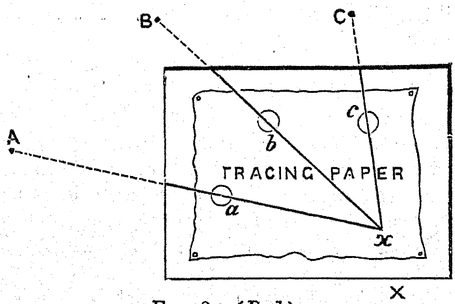



Fig. 6.—(*Bad.*)

moved considerably to the right and left without displacing the several lines on the tracing paper off the stations $a$ $b$ $c$ on the board.

For further information on this subject, see a pamphlet, 'On the Station Pointer,' published by the Admiralty, and sold by J. D. Potter, 31, Poultry, E.C.

(4.) *Orienting and fixing by the Compass.*—Set up the table over the station X to be fixed, represented by $x$ on the board (Fig. 7, p. 105); place the edge of the compass-box against a line drawn on the paper where the

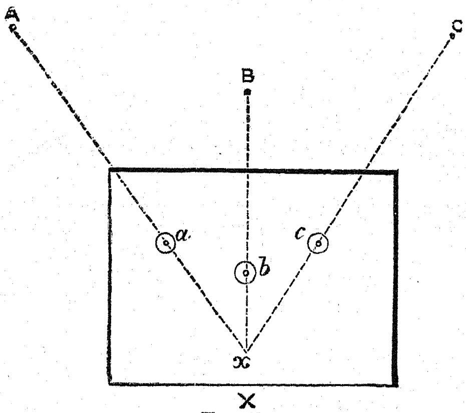


FIG. 7.

needle pointed to north at one of the previous stations, unclamp the table, and turn it about until the needle again points to north. Clamp the table, which will then be oriented. Stick in a pin at $a$. Place the fiducial edge of the ruler against it, and turn it until the sights point to A on the ground; draw a line towards you by the ruler, and the desired point will be somewhere on this line.

Stick a pin in at $b$, and with the fiducial edge of the ruler against it, turn the sights on B on the ground, draw a line towards you by the ruler, and the intersection with the line drawn from $a$ will be $x$, the point desired. Using C in the same way will test the accuracy of the work.

*Shifting the Paper.*—When one sheet is full and it becomes necessary to replace it by a new one, to continue the survey, it may be done in the following manner:—Draw a line through the farthest point fixed from

the last station. Take the sheet off the table and fix another on, drawing a line upon it in a part most convenient for the work; then cut the sheet just taken off, by the line drawn on it; apply this edge to the line on the new sheet, and as they lie in that position, continue the lines from the other station on the new paper, and prick through the positions of as many stations that have been fixed on the old sheet as you conveniently can. If the positions of three fixed points are thus transferred to the new sheet, the place of a new station can be found in the manner shown in Figs. 2 or 3 and 4. On each new sheet place the compass, and revolve the table until the needle points to north, and then draw a dark line which will represent magnetic north, unless the needle is deflected by the influence of local attraction. The better plan, if provided with a watch and sextant, will be to find the true bearings of some conspicuous object, in the manner shown on page 206, and mark it on the table.

To join the sheets together, and thus form one rough map, place the edge of the sheet that has been cut *accurately* against the line drawn on the new sheet, and with the aid of the ruler, see that the line projected on the new sheet from the last station (on the sheet that has been removed) is an exact continuation of the corresponding line on that sheet.

When a survey has to be made of a considerable tract of country, it will be necessary to construct the graticules of a map, including the area, with the tables (pp. 67–72), and in the manner there described. Place this map on the plane table and mark on it, either by pricking through, or by latitude and longitude, positions which have been previously approximately fixed by triangulation, or by astronomical observation. On one of these positions which promises to give the most extensive view of the country to be surveyed the plane table should be set up, and oriented, that is, with its meridians as nearly true north and south as possible. The best way of doing this will be, if provided with a sextant or theodolite, to determine the true bearing of one of the fixed points by its angular distance from the sun, in the manner shown pp. 206–207; and by placing the edge of the alidade on the spots indicating the position of the plane table and the position of the fixed point, the true bearing of which has been determined. Turn the table round until the hair in the sights covers the fixed point, then, if the map has been properly projected and the positions of the fixed points accurately laid down, the

plane table will be accurately oriented for the true north and south. This should be tested by drawing rays from the other fixed points, and it will very probably be found that they do not exactly meet at the point indicating the position of the plane table. It may be possible, by twisting the plane table a little to the right or left, that all the rays may be made to fall on the same point, in which case this point will be the position of the plane table on the map; but should this not be the case, then recourse must be had to the method shown pp. 100 to 103. If care has been taken with the projection, it is not at all likely that anything will be wrong with that, and therefore too great care cannot be taken in plotting the fixed points on the map.

Having the plane table thus fixed and oriented in the true meridian, place the compass on the sheet and move it until the needle points to magnetic north while the plane table is in this position; this will enable the surveyor to approximately orient his table in the true meridian should it be set up in a position where he is not able to orient it by points previously fixed. It must, however, be borne in mind that there are countries, such as portions of South Africa, where the local deviation is so variable and so great that this method cannot be depended on.

In many countries which the explorer may visit there are no fixed points, in which case it will be necessary for him to determine by astronomical observation the latitude and longitude of each end of a base, and from these fix the positions of a certain number of prominent points by triangulation. This being done, he must proceed to fix other points by moving his table to different stations, orienting his table, and drawing rays to them; the intersections of the rays drawn from any two stations to the same point will fix the position of that point provided the angle of intersection is well chosen, *i.e.*, neither too obtuse nor too acute.

*Broken Survey.*—The directions given above comprise briefly the fundamental rules of more accurate plane-tabling.

A map, however, may be, and often must be, constructed without the continuous connection of fixed points from sheet to sheet, as is above suggested, and which, in the rough work of an ordinary journey, is frequently impossible.

The traveller may often find that the station from which he wishes

to observe rays is beyond the limits of his last sheet, and that none of his fixed points will fall upon it.

In this case he must assume a convenient point on his board as his position, turn the board in a suitable direction with regard to what he wishes to do, and sighting, if possible, one of his old stations, draw a line towards it. Should another former station be visible, another line should be drawn to it. The magnetic meridian must also be drawn by means of the compass. These three lines will enable him to place his new sheet in proper relation to his former one, by arranging them with the meridian lines parallel, and moving one until the continuation of the lines passes through the two former stations. They can then be pasted together in that position, joining them by another strip of paper, if necessary.

Even should there be no fixed stations in view, rays drawn to objects he wishes to fix will be useful, always supposing that he can afterwards fix the position by rays drawn from other stations, never omitting to place the magnetic meridian on the sheet.

New bases must occasionally be measured, and it will be found that one of the chief charms of such surveying lies in surmounting difficulties in the construction of the map. Devices for so doing will suggest themselves in increasing numbers as the traveller gains experience.

Though reliance on the compass should be avoided if possible, from its uncertainty, owing to local attraction, recourse must frequently be had to it, and under favourable circumstances, plane-tabling by its aid gives excellent results.

*Concluding Remarks.*—On leaving a station, the traveller, when possible, should leave some distinguishing mark behind him, so that he may be able to recognise it again. Where it is possible, as will frequently be the case, he must carefully note the changes which take place in the landscape during his march; he will also do well to write on the plane table sheets the native names of such hills, or conspicuous objects, as he may have fixed on the table, as natives generally know these objects again when viewed from another station, which, from their changed appearance, a stranger would be very unlikely to do. Paper mounted on very thin cloth, and cut to the size of the plane table, will be found serviceable, as it will not easily tear, and can be rolled up and kept in a tin case until wanted. The traveller should also provide himself with

a waterproof case into which he can slip the plane table in the event of heavy rain.

From each station draw in the features of the ground around it as far as you are able. Rough sketches, made in a sketch-book, will help to complete the drawing, and the work from other stations, when you have obtained the rays from them.

A pocket (or box) sextant is a valuable adjunct for plane-tabling, as in certain cases the objects may be so crowded in one direction as to confuse the rays if they are all drawn on the board. Angles measured and recorded in a note-book can be plotted hereafter when working up the plan in the tent.

The scale on which to work must depend entirely on the nature of the country, and the objects in view. For a small tract of country, with much detail, one inch to the mile is good. For more extended areas two or four miles, or even more, to the inch is sufficient.

### Method of Making Route Surveys through Jungle or Forest, or on a Steep Hillside.

*By the late* General R. G. Woodthorpe, R.E.

In speaking of this method of surveying, the late General Woodthorpe says:—"I first adopted it in 1871–72, during the preliminary reconnaissances in the Garo Hills Expedition, when the nature of the country passed through prevented any stepping off the path, and the hostility of the Garos prevented any lagging behind. The method was as follows: Just before starting on the day's march, I compared the direction of my shadow with each of a round of bearings taken with a prismatic compass; and on starting, I took the general direction of the road with the compass, and rays to any known points. During the march also, any great changes in the direction of the road were taken with the compass, but all minor changes of direction I obtained by watching my own shadow when the sun was behind me, and the shadow of a man in front when the sun was before me; and whenever a halt was made, I checked the bearings of my shadow anew, to find the variation due to the sun's motion during the day.

"A little practice soon renders one very independent of the compass

for short distances, and I could generally guess a bearing to within 2° or 3° of the truth. This error in short distances, when the route is not plotted to any large scale, is of no importance. To find the distance, I noted the time taken in traversing each by a watch reading seconds, occasionally pacing one hundred yards to find the rate of going, all halts or checks, of course, being noted also.

"By this method, frequent stoppages of the whole line in a narrow path, from which it was impossible to step aside to take compass readings, were avoided. The compass is often affected by the proximity of arms and accoutrements, and this difficulty is also overcome. The changes in the direction of a path through jungle, or on a hillside, where there is no made road, are very frequent; and observations of shadows enable one to determine, without observing the compass, whether the direction of the path really changes, or only alters for a few yards, resuming the old course again. Accurate measurements by pacing are only obtainable by keeping up a continuous steady walk, which it is impossible to do with the frequent checks, or spasmodic accelerations of pace on a line of march; but I found by repeated trials that the rate of a column does not vary nearly so greatly as the pace of any one individual in it. Considerable practice is necessary to acquire accuracy in steep ground, but in tolerably easy country I found I could easily obtain it. Fortunately for this method, all countries are not so sunless as England. On one occasion, I made a route survey in this way for about forty miles of hill and dale, with only one check ray to a known point; and when it was transferred to an accurate survey, which was afterwards made of the country traversed by it, its last station was found to be hardly out at all in latitude, and not half a mile in longitude. In the cold weather of 1876–77, I had to survey some rapid shallow streams running through dense jungle, and whenever we were going with the stream in our dug-outs (*i.e.*, native boats, each hollowed out of a single tree), I found the best plan of surveying was with a prismatic compass, suspended in gimbals mounted on a small tripod-stand set up in front of my seat in the boat. I measured certain distances along the bank, and carefully noted the time my boat took to pass them, carried down by the current only. The compass gave the bearing throughout the length of the reach, and the watch gave the distance, and I found quite sufficiently accurate results were obtained. In actual measurements of shallow streams, when

a subtense instrument is not available, I found canes to be invaluable. They grew everywhere in the forests in Assam, and lengths of one hundred feet each were easily procurable. Their lightness caused them to float on the surface of the water, they were constant as to their length, and gave no trouble to the chainmen in pulling them taut in the water. They were also very useful in measuring through the jungle and forest undergrowth, through which they could be drawn without being caught by thorns in the bushes, advantages not possessed by chains or ropes."

### Surveying with the Tacheometer.

(*For description of this instrument, see* p. 35.)

The method of surveying with such a tacheometer as that shown (p. 36), is, as regards fixing positions of distant objects, the same as with the prismatic compass. This instrument has, however, this advantage over the prismatic compass, that distant objects are seen much more distinctly through the telescope, and the bearings can therefore be more accurately taken than when the ordinary sight vanes of the prismatic compass are used. In addition to which, the compass is larger than the prismatic compass usually carried by the traveller. The principal advantage of the tacheometer, however, will be found when it is employed for fixing positions within comparatively short distances. This is done by sending an assistant to the spot it is desired to fix, with a staff such as is shown (p. 38 or 39), and with the micrometers, measuring the angle it subtends when held (either horizontally or perpendicularly) at right angles to the line of sight, at the same time taking the compass reading through the prism. With the angle measured by the micrometers, if a ten-foot staff has been used, knowing the value of the micrometer divisions, the distance of the object can be at once obtained from Table XXIII. With the distance so found, and the bearing which has been taken, the position of the object can be at once laid down on the survey by setting out the bearing from the point of observation, and then measuring the distance, taken from the scale of the map.

With any other length of staff than ten feet, Table XXIII. (p. 280) cannot be used without calculation, and the distance of the object will have to be computed. It is usual, when observing the angle subtended by the staff,

to measure half of it with each micrometer, the sum of which measures will, of course, be the whole angle subtended. The distance from the staff is computed in the following manner :—Multiply the total number of divisions used in *each* micrometer by the value of a single division of that micrometer, add the results together, and this will be the value of angle in *seconds*. Divide the length of the staff, in feet, by the angle in seconds and multiply the result by the cosecant of $1'' = 206265$. This will give the distance between the instrument and the staff, in feet.

*Example:*—Length of staff, 12 feet; divisions used, Left Micrometer, 581·9, value of each division, $2''\cdot31$; Right Micrometer, 575·2, value of each division, $2''\cdot04$.

| Left Micrometer. | Right Micrometer. |
| ---: | ---: |
| 581·9 | 575·2 |
| 2·31 | 2·04 |
| 5819 | 23008 |
| 17457 | 11504 |
| 11638 | 1173·408 |
| 1344·189 | 1344·189 |
| | The angle in seconds = 2517·597 |

ft.
Log. 12 = 1·079181
Log. 2517·6 = 3·400986
$\bar{3}\cdot678195$
Cosec. $1''$ = 206265 Log. = 5·314425
Log. distance in feet, 983·2 = 2·992620

The rod, though convenient, is not, however, absolutely necessary, as distances can be measured by this class of tacheometer without it, by making an assistant set up two staves at a carefully-measured distance from one another, and at right angles to the line of sight. The angle subtended by these staves is measured with the micrometers, and the distance computed in the manner already shown.

A theodolite with fixed hairs, such as described (p. 39), may often be used for measuring distances approximately when it is impossible to read the markings on a graduated staff. This is done in the following manner :—An assistant should be sent to the object, the distance of which is required, and directed to place a staff in the ground. The surveyor must then cover the staff with one of the fixed hairs in the instrument, after which the assistant must move, very slowly, in a line at right

angles to the line of sight until he is covered by the second fixed hair, when he might be stopped by some pre-arranged signal, and place another staff there. He must then carefully measure the distance between these two staves, which distance multiplied by the ratio between the value of the hairs, which is generally 1 in 100, will be the distance of a point, midway between the two staves, set up by the assistant, and the observer. Thus, if the measured distance between the staves was 10 yards, the distance from the instrument would be $10 \times 100 = 1000$ yards.

Surveying on the tacheometer principle, but without a tacheometer, may be carried to greater distances in the following manner.

Supposed a densely wooded plain over which it has been impossible to preserve any record of the distance travelled, but with elevated country at its extremities, the distance between points on the elevated lands may be very accurately found by measuring a base on one at right angles to the position on the second, of such a length that it will subtend an angle of two or three degrees to an observer at the second point; and marking these ends either by choosing conspicuous trees or other marks, or by flashing from them with a mirror, or by making fires. The observer obtains the angle by a sextant or theodolite between the ends of the base, and by simple right-angled trigonometry calculates the distance.

## Bar-Subtense Survey.

At the meeting of the British Association at Cardiff, 1891, the late Colonel H. C. B. Tanner, Indian Staff Corps, read a paper on Bar-Subtense Survey, from which the following is extracted:—

The Bar-Subtense method has none of the drawbacks attending the use of the chain or of micrometer instruments; it is more accurate than either, and is effected by means of an ordinary theodolite, together with bars of varying lengths, according to the nature of the work to be performed.

The system is readily acquired by native surveyors after a week's instruction, and in their hands, over the roughest possible mountain tracts, is capable of furnishing horizontal measurements up to a maximum of some two miles with an error of about three feet per mile, and up

to a distance of three miles with a somewhat greater error; and an adaptation of the process is capable of yielding reconnaissance traverses and approximate trigonometrical work far more accurately and expeditiously than can be looked for by any other means, unless a regular trigonometrical survey be resorted to.

The theodolite used should be six-inch or larger; it should be simple in construction, and furnished with one vertical and one horizontal wire. The bars may be of varying lengths. In the Himalayas the 20-foot bar was in general use, but ten and two-foot bars were found convenient for some purposes. A 20-foot bar with 12-inch circular discs * is capable of furnishing, under favourable conditions of light and atmosphere and by a skilled observer, a 3-mile distance with an error of six feet. A ten-foot bar with eight-inch discs will give good results up to a mile and a half, and a two-foot Gunter's scale blackened at the ends with two-inch paper discs pasted on two feet apart, and properly mounted, will give distances up to 20 chains.

The *modus operandi* of a traverse surveyor must now be explained in detail.

The forward signalman sets up the horizontal bar over the station mark, and then, by means of the folding sight-vane, directs the bar at right angles to the observer, who then intersects and records the reading of the back signal. Then, leaving the lower clamp fast, he releases the upper plate and intersects the right-hand disc of bar, the reading of which he records.

Now release lower clamp (leaving upper clamp fast) and intersect left-hand disc. Again release upper plate and intersect right-hand disc, and for a second time the left-hand disc with lower plate, and so on, continuing the repetition until, say, ten times, and then read and record the right-hand disc. In this operation the graduated limb of the theodolite will have moved over an arc ten times greater than that subtended by the bar. Now repeat again, ten or twenty times, and record readings of right-hand disc, and then, having taken a vertical angle to bar, and leaving lower plate fast, intersect, and record the reading of back signal with upper tangent screw, and such a record as I here show will have been obtained:—

* For illustration, see p. 38.

| Signals observed. | | Reading of A vernier. | Differ-ences. | Subtended angles. | | Error of 20 ft. bar −0·2 of an inch. |
|---|---|---|---|---|---|---|
| | | ° ′ ″ | ° ′ ″ | | ′ ″ | |
| Back station . | A | 126 14 20 | | | | |
| Right-hand disc | B | 206 26 30 | | | | |
| ,, ,, . | $B_2$ | 209 48 30 | 3 22 0 | $d$ | 20 12 | |
| ,, ,, . | $B_3$ | 213 10 15 | 3 21 45 | $d_2$ | 20 10·5 | |
| ,, ,, . | $B_4$ | 216 32 5 | 3 21 50 | $d_3$ | 20 11 | |
| Back station . | $A_2$ | 136 19 55 | M 20 11·2 = $x$. | | | |
| (30 repetitions) . | | 10 5 35 | From Table, Chains . . | | | 51 60* |
| | | 10 5 35 | Correction † . . . − | | | 4 |
| Subtended angle | $x$ | 20 11·2 | Corrected distance . . | | | 51 56 |

| | | ° ′ ″ |
|---|---|---|
| Traverse angle :—B−A (= $B_4 - A_2$) | | 80 12 10 |
| $\frac{x}{2}$ | − | 10 5 |
| Angle at station 1, between back station and centre of bar at No. 2 .. .. | | 80 2 5 |

A 10-foot bar with an error of 0·2 of an inch would give—

| | | |
|---|---|---|
| Chains .. | .. | 25·80 |
| Correction | .. − | ·08 |
| Corrected distance, ch. | | 25·72 |

A 2-foot bar with an error of 0·02 of an inch would give—

| | | |
|---|---|---|
| Chains .. | .. | 5·16 |
| Correction | .. − | 1 |
| Corrected distance, ch. | | 5·15 |

* For actual use the distances have been tabulated between 2 and 180 chains.

| | | |
|---|---|---|
| † Bar = 20 ft. = 30·3 lks. | log. | 1·48144 |
| 20′ 11·9″ | cosec. | 2·23122 |
| 51·60 | log. | 3·71266 |

I wish to draw attention to the complete system of checks on the observations furnished by the above record. In the first place, there are two values of the azimuthal or traverse angle $B - A$ and $B_4 - A_2$, both of which should nearly correspond, and show only trifling differences.

The subtended angle, or $x$, which is D divided by the number of repetitions, should correspond very closely with $d_1$, $d_2$, $d_3$, and, as a check on the arithmetic, it should agree exactly with the mean of $d_1$, $d_2$, $d_3$. These values are taken out during the progress of the observations, and should one of them show even a small discrepancy, the work must be condemned and done *de novo*. Again, $A_2 - A_1$ and $B_4 - B$ must agree very closely. The checks are such that, by examining his record, the observer can make certain before proceeding to his next station that he has obtained the correct distance. Up to a mile he can detect any error made by the signalman in placing the bar at right angles, for it is only when exactly set that the black lozenge at the end of the sight-vane of the bar appears to him in the middle of the white patch on the bar itself.

The signalman soon learns to place the bar sufficiently near the horizontal for practical purposes. An error of 2° of dislevelment, which would seldom occur in practice, would only produce an error of about three inches in a mile.

The manner in which this method may be made applicable to other classes of survey is shown in Col. Tanner's paper, published in "Proceedings of the Royal Geographical Society," November, 1891.

### Surveying with the Theodolite.

(*For a description of the instrument, see pp.* 23 to 35.)

*Traversing.*—There are several methods of traversing with the transit theodolite: (1) by making any convenient point zero and *measuring all angles with reference to it;* (2) by making the station last left zero, and measuring all angles from it; (3) by making a line joining the second and first station zero and measuring all angles from that line. The principle involved in each of these is the same, viz., making zero with the lower set of screws and measuring all angles with the upper set of screws. The distances between each of the stations along the route traversed must be measured.

The following is an example of the first method, traversing from A to D.

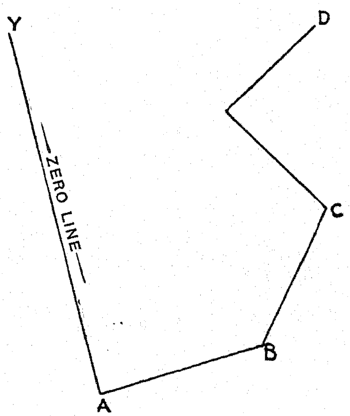



FIG. 1.

Set the theodolite up at A (Fig. 1), level it, and adjust it for parallax in the manner described, p. 26. Set one of the verniers of the vernier plate to 360° and clamp it. Loose the clamp of the lower plate, direct the telescope on the point Y chosen for zero, and, using the *lower* set of screws, bisect it with the cross threads in the diaphragm of the telescope and clamp it firmly. Release the compass needle and note the bearing. Now, keeping the lower clamp fast, release the clamp of the vernier plate and take a round of angles to all objects the positions of which it is desired to fix, only using the upper set of screws; then turn the telescope on the next forward station, B, bisect it with the cross threads of the diaphragm, using only the *upper* set of screws. Note the reading of the *same* vernier which was set to zero, and keeping the plates clamped at this reading carry the theodolite to the next forward station, B, where it must be set up, the *lower* clamp being loosened for levelling it. With the two plates still clamped together, turn the telescope back on A, using only the *lower* set of screws. When this is done, release the clamp of the vernier plate, and take a round of angles as before, finishing with

the angle to the next forward station, C, the angles being read from the *opposite* vernier to that previously used. When the forward angles are taken to the *right* of the zero line, *passing through a station*, they will be less than 180°, when to the *left* of the zero line they will be more than 180°. By noticing this it is easy to tell which vernier should be read. The traverse is carried out in this manner to all the forward stations, reading the angles alternately on the two verniers. Should the traverse be carried to a closing point, as from D to Y, the vernier of the vernier plate should be at zero when the theodolite is set up at Y, and the point A bisected with the cross threads of the diaphragm. The approximate accuracy of the work may also be tested at each forward station, by setting the vernier to 360°, when one end of the compass needle should point to the bearing noted of the zero line. In plotting the work it must be borne in mind that all angles are plotted with reference to the zero line.

The second method differs from that previously described, in which all angles are referred to a common zero line, as it consists of making the station last left zero, and taking rounds of angles at each station to the points it is desired to fix. The compass bearing of the second station from the first station must be recorded.

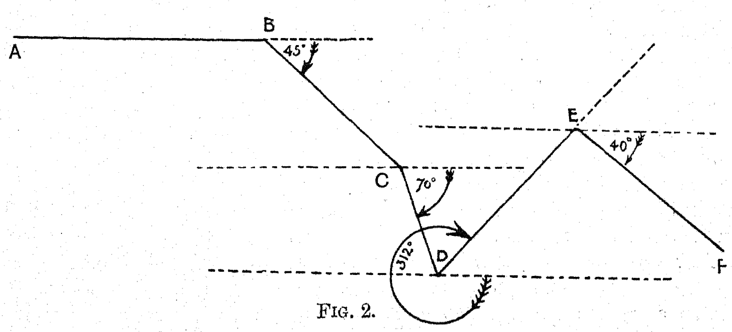



FIG. 2.

| | ° | Diff. ° |
|---|---|---|
| *Bearings* A to B .. .. | 180 | |
| B to C .. .. | 225 | |
| C to D .. .. | 250 | 25 |
| D to E .. .. | 132 | 118 |
| F to F .. .. | 220 | 88 |

| *Angles* | ° | Diff. ° |
|---|---|---|
| B to C .. .. .. .. | 45 | |
| C to D .. .. .. .. | 70 | 25 |
| D to E .. .. .. .. | 312 | 118 |
| E t F .. .. .. .. | 40 | 88 |

The third is a method of observing and recording the different directions of successive portions of a line, such as a boundary, or route, so as to read off on the instrument at each successive point or station the angle which the route or boundary makes with the first line observed, which is called the zero line, and *not* with the preceding line.

The operation consists essentially of taking each *back* sight with the *lower* set of screws (which moves the theodolite without altering the reading) and taking the forward sights with the screws of the vernier, or *upper plate*, which moves the vernier over the arc measuring the new angle; and thus adds it to or subtracts it from the previous reading.

Set up the theodolite at some station, as B (Fig. 2); set the vernier at 360°, and by the lower set of screws sight back on A. Tighten the *lower* clamp, *reverse* the telescope, loosen the *upper* clamp, and sight to C by the *upper* set of screws, and then clamp the vernier plate again and record the reading. Remove the theodolite to C, sight back to B by the *lower* set of screws (*keeping the upper set clamped at the previous reading*), then clamp the lower motion, *reverse* the telescope, unclamp the vernier plate and sight to D by the upper set of screws, and record the reading. Then go to D and proceed as at C, and so on. The readings of the upper plate vernier give the angles *measured to the right* or "with the sun," as shown in the arcs in the figure.

Care should be taken to keep the same side of the instrument ahead and read the *same* vernier throughout. It is advisable to take the compass bearing of each line of the route to serve as a check on the observations; for the difference between the magnetic bearings of any two lines of route should be the same *approximately* as the angles between them measured by the theodolite. The bearings also prevent any ambiguity as to whether the angles have been taken to the right or the left.

Rounds of angles can be taken at each station for fixing the positions of objects along the route, which, like the line of route, must be measured from the first or zero line.

*Triangulating.*—Although an explorer will seldom have time or opportunity for carrying out the triangulation of any extent of country, there are occasions on which he may be able to do so, and though he cannot hope to make this class of survey with the detail with which government surveys are carried out, there is no reason, if he can spare the

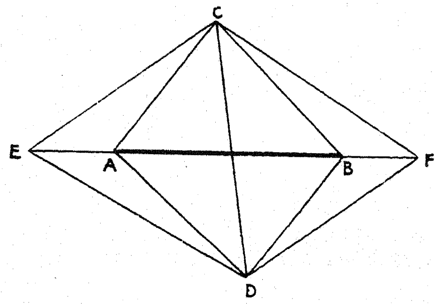
time, why he should not attain a considerable amount of accuracy and do good preliminary work.

The first point to which he must give his attention is the selection of his base, which must bear a fair proportion in length to the distance of the points he desires to fix, and must be so situated with regard to those points as to give well-conditioned angles.

If the country in which he finds himself is open, and fairly level, the difficulty of measuring his base, with the chain or steel tape, will not be very great, but care should be taken, as the accuracy of his survey will depend on the length of his base being correctly known. If the ground on which the base is measured is sloping, the distance measured must be reduced to the horizontal in the following manner:—Observe the angle of slope with the theodolite and read, on the back of the vertical circle where they are usually given, the number of links which have to be subtracted from *each* chain to give the horizontal measurement of the base. If these figures are not given at the back of the vertical circle, then the horizontal distance must be calculated, with the observed angle and the measured distance as the hypothenuse of a right-angled triangle. In some mountainous countries it is quite impossible to measure a base in the usual manner, in which case the Bar-Subtense system, described pp. 37 to 40 and 111 to 116, may be used with advantage. There are places where the country is so densely wooded and hilly that it is next to impossible to get a measured base, in which case resort must be had to a geographical base as described by Sir Charles Wilson, p. 90; but as the length of such a base depends entirely on astronomical observations, which will in all probability, under the circumstances, contain errors, it is not a system to be recommended if it can possibly be avoided. It may frequently happen that considerable difficulty would be experienced, owing to the nature of the ground, in measuring a base of sufficient length to give well-conditioned angles from each of its ends to the points to be fixed, but if only a portion of the base is measured it can be extended by calculation without measurement, by either of the following methods:—

When the measured base A B can be conveniently prolonged in both directions towards E and F, select two temporary stations, points C and D, so that the resulting triangles A C B and A D B may be well conditioned; observe all the angles of these two triangles and calculate

the side C D through each triangle, thus verifying the result; then choose two points, E and F, the prolongation of A B, so that the triangles




C D E and C D F may be well conditioned. Observe all the angles in these two triangles, and calculate E F twice through the separate triangles.

When the prolongation can only be conveniently effected in one direction, as towards F, a corresponding method can be adopted, which differs only in being one-sided. Choosing points C and D, rather more towards F, and observing all the angles, compute B C and B D; then, choosing F, so that C D F may be well conditioned, and observing all the angles, compute B F both in the triangle B C F and in B D F, thus verifying the result.

Having selected and measured a base, set the theodolite up immediately over one end of it, and see that the ends of the tripod legs are well thrust into the ground, or better still, placed on pegs driven well into the ground. Level the instrument carefully, and get rid of parallax in the manner described, p. 26. Set the vernier of the vernier plate accurately to 360°, and then unclamp the *lower* plate, and keeping the vernier clamped at 360°, move the telescope round until the intersection of the threads of the diaphragm are nearly on the mark at the other end of the base. Clamp the lower plate, and by means of the *lower* tangent screw, cover the mark with the intersection of the threads in the diaphragm; now release the clamp of the vernier plate and turn the telescope on each point in succession which it is desired to fix, moving

the telescope from left to right, and recording the angles in the field book. Having completed the first round of angles, move the instrument to the other end of the base, and the end at which the first round of angles was taken will now have to be made zero, and another round of angles taken in the manner just described. The reading off the angles should be taken on the vernier originally set to zero, or the readings of both verniers, and, if they differ by more or less than 180°, taking the mean as the correct reading.

In fixing points in the above manner, care should be taken, where possible, to select two points which will serve for a base in carrying on the triangulation, and the angles of elevation should be taken, face right and face left, to all peaks or points the heights of which it is wished to determine. After each round of angles, the telescope should be directed on zero, and the vernier of the vernier plate should then read 360°; if it does not, the instrument must have been moved, and the round of angles must be taken again. Accuracy will be insured by repeating the measurements of the horizontal angles. This is done by moving the vernier forward, say 1° with the upper set of screws, and again directing the telescope on the zero point with the lower set of screws, then taking the round of angles again, which, if correctly taken, will differ from those of the previous round by exactly 1°. It must be remembered that the upper screws are used for setting the reading to 360°, and that the zero point is always made with the lower set of screws, which latter must not be touched again until after a round of angles has been taken.

The bearing of the base line must be taken, and the best way of doing this is by determining its true bearing from its angular distance from the sun, as shown pp. 206, 207, roughly by taking its bearing with the magnetic needle.

In using a theodolite in exploring, it has generally been found very advantageous, when taking rounds of angles, to set up the instrument so that all recorded readings are magnetic bearings. This is done in the following manner: Having levelled the instrument, set one of the verniers of the vernier plate to 360°, and clamp it, release the clamp of the lower horizontal plate and move the whole instrument round until the north end of the magnetic needle steadily points to the north in the compass-box, or trough, and then clamp the lower plate, release the vernier plate, and all readings will now be magnetic bearings. There

are, however, countries where this system cannot be carried out, such, for instance, as portions of South Africa, where the local attraction, owing to the presence of magnetic iron, varies so much that the compass is rendered useless for this purpose. A note should always be made in the field-book when this system has been adopted.

## Photographic Surveying.

*By* J. Bridges Lee, M.A., F.G.S.

Since the last edition of 'Hints to Travellers' was published, numbers of people in different parts of the world have been working at the practical development of "Photographic Surveying." A vast amount of most excellent photographic survey work has been done in Canada and other countries. Text-books specially devoted to the subject have been published and instrumental appliances have been very much improved, and surveying by photography is now one of the recognised means by which reliable maps may be made.

### *Practical Advantages for Travellers.*

For travellers especially the method has certainly great advantages. For example:—

1. Anyone who is compelled by circumstances to travel quickly may be able to find time and opportunity to expose a few plates, though he could not find time to stop many hours or days to make and record a large number of observations at selected station points.

2. Good photographs commonly contain records of an amount of detail which could not possibly be plotted from direct observations in the field without the expenditure of a vast amount of time.

3. The traveller is not so exclusively dependent upon himself or his immediate assistants for the accuracy and completeness of his work as he would be if he employed exclusively any of the better-known methods. He can invoke the aid of skilled photo-topographers at home, and he need do little more himself than to select and fix his station points with care and expose his plates with judgment.

4. The photographic method can be conveniently used in conjunction with more ordinary methods. No matter what method is chiefly used it must always happen that details between fixed points have to be filled in from sketches or photographs or by estimation on the spot, and no doubt survey photographs will always be useful to help to fill in details in an ordinary survey.

5. Survey photographs can be conveniently used to check field work and detect important mistakes where such have been made, and in any case they will serve as corroborative evidence of the accuracy and completeness of work done. By no other means can important errors be rectified, except by revisiting the ground, which may sometimes be very inconvenient or impossible.

6. It is always useful to know the general aspect and appearance of a country traversed. Ordinary photographs may suffice to give some general impressions, more or less accurate, but they cannot compete with a systematic series of good survey photographs.

7. A set of good survey pictures from well-selected stations, the exact positions of which are known, will always form a valuable record for future reference, and would afford most useful information to future travellers in the same country.

Most of these advantages are self-evident, but until recent years it has not been easy for travellers to profit by them, partly because it has been difficult to obtain really efficient instruments for photographic survey work, and partly because there were no good practical text-books to instruct beginners concerning the practical details of the photographic methcd. These obstructive difficulties have been now, to a large extent, overcome.

Good photo-surveying instruments can now be purchased for about £45 or £50, which can be trusted to yield good reliable photographs from which maps can be drawn. The best instruments yield pictures which bear on their faces automatic records of nearly all the information which is necessary to enable anyone who understands map-making to draw maps from them.

Fig. 1 is an illustration reproduced from 'Engineering' of one of those instruments known as the Bridges Lee photo-theodolite.

Essentially, the instrument consists of a fixed focus stand camera with accurate levelling adjustments and mechanism inside the box for record-

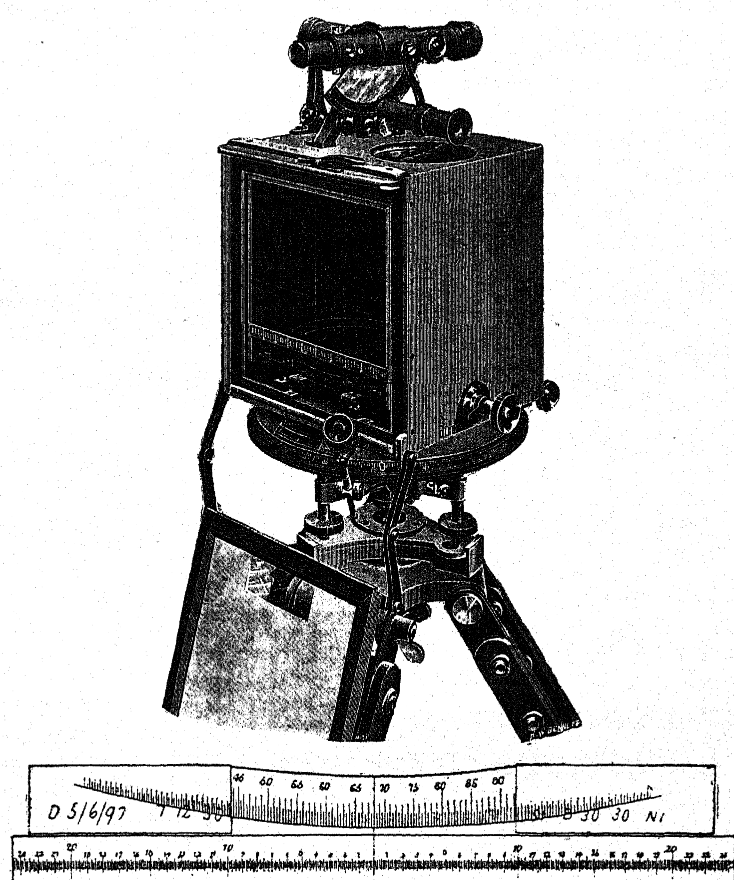


Fig. 1.

ing automatically on the negative (at the same time that the view is exposed):—

1. Trace of the principal vertical plane.
2. Trace of the horizon-plane.
3. The principal point of the perspective (at the intersection of 1 and 2).
4. The orientation of the view.
5. A scale of horizontal angular distances for all parts of the picture.
6. Memoranda concerning station number, serial number of picture, magnetic variation, barometric pressure or altitude of station, date, time, alignment of principal plane, etc.

These memoranda are first written on slips of celluloid, and inserted in place in the camera, where they print as shadowgraphs on the negative at the same time as everything else.

The internal mechanism is very accurately adjusted in relation to the lens at the time the instrument is constructed, and it is operated by a rack and pinion which carries the whole mechanism on rails either forward in the box, where it is automatically clamped at all ordinary times when not in use, or back against a photographically sensitive plate when the compass is automatically released and everything in accurate position for exposure. An optical colour screen is fitted in front of the lens to diminish the obscuring effect of the blue haze of distant views.

The whole apparatus is so constructed that when it has been accurately levelled by the levelling screws and levels the principal optic axis of the photographic lens must be truly horizontal and the back frame against which the dry plate will be pressed will be truly vertical and at right angles to the principal axis. The box of the camera is best made of cast aluminium alloy, and revolves on a vertical axis.

For the rest, it is not essential for photographic survey work that the camera should be wedded to a theodolite, though in many ways it is convenient that it should be. The instrument shown in the illustration (p. 125) has a divided horizontal limb below the camera, and carries a telescope on the top with a divided vertical arc for reading elevations; and there are verniers, clamps, tangent screws and microscopes, which need no special descriptive notice in this place. The particular instrument here illustrated was made by Casella, who charges £45 for instruments of this type. Other instruments much more complete and

better finished as theodolites have been made by Troughton and Simms. For example, their instruments carry a larger telescope which revolves on its axis, so that it can be used for sights fore and aft, and it is reversible in the Ys; there is also a complete vertical limb, divided on

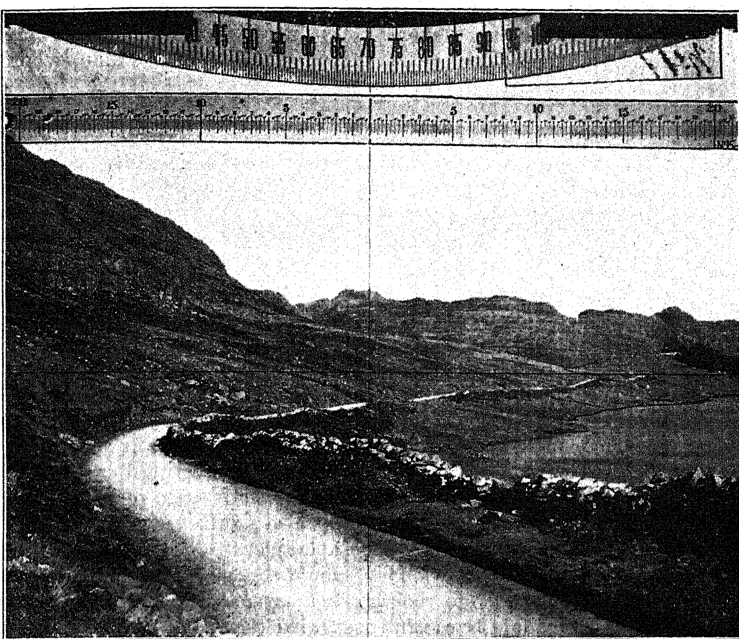


FIG. 2.

silver, and a level on the telescope. The horizontal limb is also divided on silver, and there are two verniers at opposite ends of a diameter, and various other details which render the instrument superior as a theodolite to that made by Casella. Troughton and Simms charge £50 for their instruments. As surveying cameras the instruments are practically

identical in construction, and the internal mechanism designed by Mr. Bridges Lee for giving automatic records on the picture is the same.

It may well happen that before this edition of 'Hints to Travellers' is exhausted other makers may enter the field with efficient but cheaper instruments, and further improvements may be designed, so that anyone thinking of adopting the photographic method in practice would do well first to consult the Instructor in Surveying to the Royal Geographical Society or Mr. Bridges Lee, either of whom will probably know where the best instruments can be obtained at the lowest price at the time of enquiry.

Fig. 2 is reproduced from a photograph taken in North Wales by Mr. Cripps Matheson, with an instrument fitted with Mr. Bridges Lee's automatic recording mechanism.

### *Work in the Field.*

A traveller duly equipped with a photographic surveying outfit should select his stations and fix their exact positions on his skeleton map on the same general principles and by the same means as he would adopt if he were making a plane table or other kind of survey. He must continually keep in mind the fact that to obtain an accurate map he must have good intersections for all his principal points. Also he must make sure that points, the positions of which he wishes to fix accurately, are clearly visible from two stations at least, remembering that the lens is the point of vision for the picture. A fair knowledge of the general principles of surveying is necessary, and also a sufficient knowledge of photography to insure getting serviceable pictures. Artistic pictures are not necessary, but every effort should be made to get pictures sufficiently clear and sharp to yield good enlargements.

The instrument should be carefully set up at the station and accurately levelled and used as described in the book of instructions generally supplied with it. Generally some three or four views at a station point will suffice for all practical purposes. Sometimes it may be advisable to obtain a complete round of views.

Before leaving the station suitable note-book entries should be made, and if any other surveying instruments are at hand a few direct observations may be made with them and noted if time permits.

*Work in the Office.*

The first thing to do is to plot the station points on the skeleton plan if they have not been already plotted in the field. As with all other methods of surveying it is a matter of the greatest possible importance to be sure about the correct plotting of the stations, because any errors in the positions of the station points will cause errors in the plotting of nearly all points viewed from those stations. The most thoroughly reliable results are obtained when the stations have been fixed trigonometrically. If many construction lines are necessary for fixing the exact positions of the station points, the sheet on which the stations are originally plotted can be laid over a clean sheet and the station points pricked through so as to avoid a superabundance of construction lines on the actual plan.

If no preliminary or concurrent triangulation of the area to be plotted has been effected it may be necessary to fall back on the photographs for fixing the stations like other points. Before using the photographs for actual plotting it is best to have them enlarged several diameters; three or four will generally suffice, but much depends upon the scale of the map, and, generally assuming absence of distortion, the greater the magnification the more accurate should be the results of plotting.

Let us assume now that all the photographs have been enlarged three or four diameters or more so as to have an equivalent focus or distance line of from $1\frac{1}{2}$ to 2 feet or more; it is then necessary to determine the exact equivalent focal distances for each picture, which can be easily done by multiplying the length of any straight line measured from zero along the tangent scale on the picture by the numerical value for the cotangent of the angle corresponding on the scale to that length. Note the value thus obtained on the back of the print. Then, assuming any two points at a convenient distance apart to be station points, as we may do if we are starting with a blank sheet of paper or taking any two stations previously fixed, if we have a skeleton plan to start with, the next practical step is to select views from those stations which will yield fairly good intersections for most of the points which they have in common. An inspection of the pictures will show what those points are, and a glance at the compass bearings will afford a ready indication of

the general directions of the views and the kind of intersections which may be expected.

Suppose two suitable enlarged pictures have been selected to commence plotting from such as we know, from cursory inspection, are likely to give good intersections over a fair area. The next practical step is to select and to mark, *on the picture*, with tiny dots and numbers in red ink, the points which it is desired specially to plot by intersection. The same numbers should be given to the same points in both pictures (or, indeed, on any pictures where they are visible). When the pictures have been carefully overhauled and marked in this way, the next thing to do is to mark off along one edge of a narrow band of paper the exact horizontal distance from the median vertical line of each point, and note the appropriate numbers on the band near the points. One or more separate bands are used for each picture. Next we must fix the position of the horizontal trace of the picture plane on the plan for each picture. This is done by first setting off from the stations the correct directions of the distance lines of the views by aid of a good protractor, and prolonging these distance lines until their total length equals exactly the equivalent focus for each picture. Lines drawn through the distal extremities of the distance lines so set off and accurately perpendicular to them are the horizontal traces of the picture planes.

The marked paper strips or bands are then laid on the plan so that the marked edges coincide with the picture traces and the zero of each band coincides with the point where the distance line meets the trace of the picture plane. The strips are then held in position by pins or paper-weights.

Next, pins are driven into the station points, and hairs or threads of silk or cotton, looped at one end, are slipped over those pins. At the other end they are tied to elastic threads, which are fixed at their distal ends to paper-weights, so that when the weights are laid on the plan and the elastics stretched a little the threads must be straight.

Now, if the weights be shifted on the board or table until the threads (always moderately tight) pass through a dot of the same number on the two slips, the intersection of the threads marks the position of the point on the plan. In this way, all points which are common to the two pictures, and which have been marked on the paper strips, can be very rapidly plotted. The same process can be repeated with any number of

pictures from any number of stations, and intermediate details between the points plotted by intersection can be sketched in from inspection of the pictures, the accuracy of the sketching being tested from time to time by intersection tests by aid of the stretched hairs from the stations.

### *Contours.*

For plotting contours, advantage is taken of the fact that all points on the horizon line of any picture are at the same level as the camera at the station, so that if a number of points on the horizon line of a picture are plotted on the plan by the method of intersections before described, it is only necessary to join those points to obtain a correct contour line. In this way a number of contour lines corresponding to the different altitudes of different stations can be easily and rapidly laid down on the plan. Intermediate contours can be sketched in.

Sometimes it is desirable to ascertain the altitudes of particular points visible in a survey picture. This can always be done when the horizontal distances of the points from the station are known. The altitude of any point bisected by the principal plane of the picture can be obtained at once from the formula $h = d \tan a$, $d$ being distance in feet, $a$ the angle subtended at the station, and $h$ the height in feet. $a$ can be ascertained at once by measuring the distance along the tangent scale equal to the distance of the point on the picture above or below the horizon line. If the point whose altitude is required occupies any position on the picture not bisected either by the principal vertical or by the horizon plane its altitude can be determined from the same formula, only to ascertain the value of $\tan a$ it is necessary to substitute values in the formula $\tan^2 a = \frac{y^2}{f^2 + x^2}$ where $x$ and $y$ are distances measured along the horizontal and vertical lines respectively to the bases of perpendiculars let fall from the point upon those lines, and $f$ the focal distance.

### *Conclusion.*

There are other methods, also, which can be used to assist in the preparation of the plan and for plotting in contours, but the amount of space available does not permit of a description here of those other

methods, which are mostly subsidiary, and often not so accurate, or simple, or generally applicable as the method described above. For the purposes of a traveller, as before explained, it is not absolutely necessary that he should be proficient in the art of map-making from pictures. His attention should be mainly concentrated on the selection of suitable stations in the field, and on obtaining sufficient good cross views from those stations. The topographical construction work can then be carried out by experienced men at home.

The foregoing description sufficiently describes the general method adopted, which is really a kind of plane-tabling upon the pictures in place of the actual landscape views. Any reader who wishes to study the subject more deeply from a theoretical or practical point of view can in these days easily obtain very full information from a study of modern literature on the subject. The most complete special treatise at the present time in the English language is given in the U. S. Coast and Geodetic Survey Report for 1897 (Appendix No. 10), entitled "Photo-topographic Methods and Instruments," by J. A. Flemer. There is also a book entitled 'Photographic Surveying,' by Capt. E. Deville, Surveyor-General of Canada, published at the Government Printing Bureau, Ottawa, Canada, in addition to which there are many other publications in French, German, Italian and Spanish. A full detailed description of the Bridges Lee photc-theodolite, and of the newest improvements for securing automatic records of important data on the face of each picture, has been written by the inventor, from whom any further information can be obtained.

## Surveying a Country and fixing positions by means of Latitudes and Azimuths.

This system of surveying can be used with advantage in a country the surface of which is so varied as to present several prominent and distant objects.

In order to use this method the traveller must first prepare a Mercator's projection that will include the area he intends to map. The reason for making choice of Mercator's projection is, that a line of bearing drawn on

it will intersect every parallel and meridian at the same angle, thereby allowing all relative bearings to be readily and correctly laid down by straight lines, which could not be done on a map on any of the other projections in common use. After having prepared his projection, a reference to the annexed map, facing p. 134, will show the traveller how he should proceed.

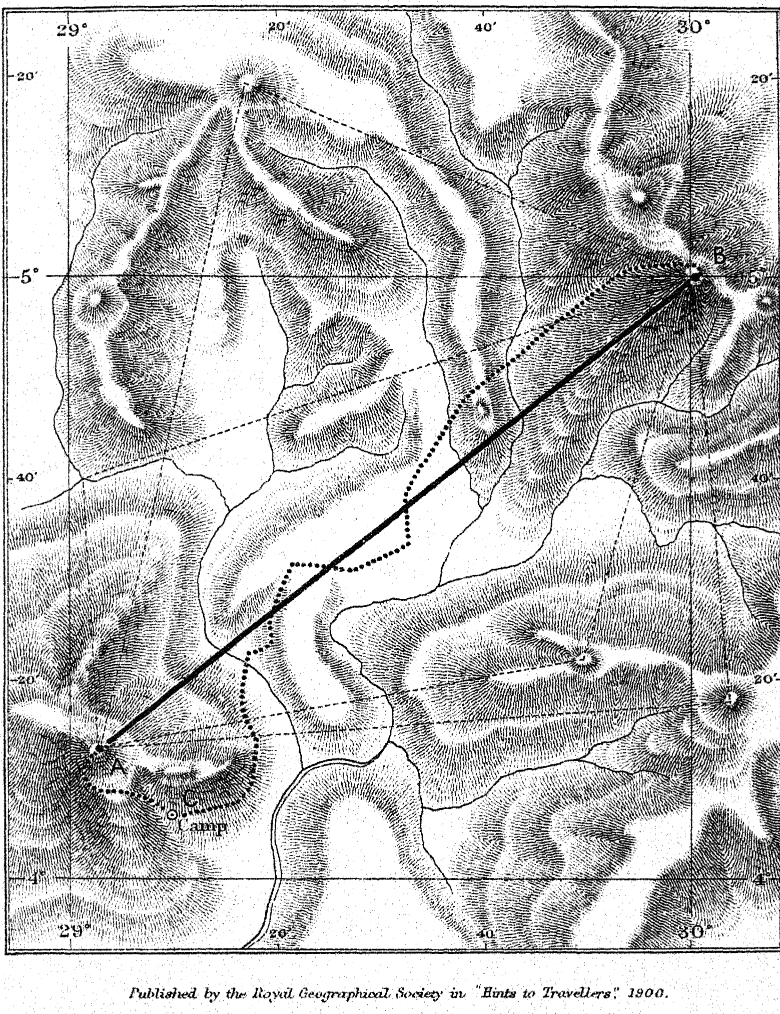
The first thing to do is to fix the position in latitude and longitude of the starting point A. This may be done by traverse, or bearings from some object, the position of which has been fixed, or by one of the methods mentioned in this book. Having done this, he should from the summit of A, look for some prominent and distant object, in the direction he is about to travel, such as the hill B on the map, and find its true bearing by measuring its angular distance from the sun by the methods shown (pp. 206, 207). If a sextant is used all such measurements must be reduced to the horizon, as shown in the example p. 206. When a transit theodolite is employed no such reduction is required, and it will only be necessary to make the hill B his zero point, and then observe the altitudes of the sun, with the vertical circle face right, and face left, in pairs (as explained p. 27), noting the times, altitudes, and horizontal angles. With the times and altitudes he must compute the sun's true azimuth (pp. 206, 207), and by applying the mean of the horizontal readings to this, he will obtain the true bearing of B.

The next step will be to set off, indefinitely, this line of bearing from A, and the point B will be somewhere on that line. Having thus obtained the true bearing of B, the true bearing of any object in sight can be at once known by measuring the angular distance between it and B. Or, if furnished with a plane-table, regarding B as the other end of the base and drawing rays to each object, marking each ray in such a manner as to prevent any future mistakes as to the object through which the ray is drawn.

We will now suppose that the traveller proceeds in the direction indicated on the map, meeting with obstacles which prevent his keeping in a direct line towards B, and that he allows his watch to run down, thus losing his Greenwich time, or the time of such other place as he has chosen for his reference meridian, and that after several days' march he finds himself in the vicinity of B. There he will have an opportunity of fixing the position of B, finding the error of his watch on his reference

meridian, and by using this station (B) as one end of his base, and drawing rays on his plane table through the points from which rays were drawn at A, making a sketch map of the country through which he has passed. In order to do this he must ascend B, and take observation by north and south stars for latitude. The mean of results so obtained ought to be very near the truth. Suppose, in the present instance, that the latitude so found was 5° N., then by placing the straight edge on that latitude on each side of the graduated meridians, and drawing a line between those two points, its intersection with the line of true bearing of B drawn from A, will be the place of B on the map. Again, placing the straight edge on the point of intersection of this parallel of latitude and the line of true bearing of B from A, and then moving it until it is parallel with the graduated meridian, it will cut the graduated parallel in the longitude of B, which in this case is 30° E. Knowing the latitude and longitude of B, the error of the watch on the reference meridian can be found by the methods given, pp. 153, 160, 162.

The weak point in this system of surveying is, that it cannot be employed when the direction of the line of route approaches east or west, as the angle between the parallel of latitude and the line of bearing would be too acute to give satisfactory results.

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# PART IV.

## ASTRONOMICAL OBSERVATIONS.

### Necessity for Astronomical Observations.

A traveller merely passing through a tract of country cannot hope to make more than a rough map of a belt extending a short distance on either side of his path.

Upon the estimation of the length of his daily march, and of its mean direction, his map will mainly depend.

The degree of accuracy of these two important factors will depend upon his experience, upon the trouble he takes to find means of ascertaining his speed, and upon his power of estimating the mean value of a course made up probably of an infinite number of windings and deviations.

When isolated or other well-marked hills exist, he may, however, on camping for the night, be able to get a bearing with his compass of an elevation at or near his point of departure in the morning, which will give a greatly improved value to the direction of his day's march.

It is, however, evident, that after a few days, especially in densely-wooded country, his position may be very much in error, and hence the necessity, if he wishes his map to be in any degree trustworthy, of fixing his position from time to time by astronomical observations, by sextant or otherwise.

These have two objects: to obtain latitude and longitude.

The latitude observations, hereafter described, are comparatively simple, and, in the case of latitude by meridian altitude, depend solely on the altitude observed.

Longitude observations are, however, more complicated, and, *whatever* method is employed, with the exception of the moon culminating star method, all *require accurate local time.* This can be found by altitudes of the sun or stars at some distance from the meridian, noting the time by the watch, and by these observations the error of the watch on local time is obtained.

By repeating the observation in the same spot after the lapse of a few

days, the daily rate of the watch can be obtained; and, supposing the watch to be in good order, and well taken care of on the march, this rate will for some days afford a means of finding the difference of longitude of any two places when observations for time have been taken.

The precise method of doing this will be hereafter described, but it is not often that in an ordinary journey it can be employed, as it requires a halt of several days from time to time, and, moreover, it is not easy to ensure the watch from accidents. It is therefore important to become acquainted with "absolute" methods for obtaining the longitude.

It must be remembered that in all observations with the sextant, unless they are so taken as to eliminate the errors of the instrument, great errors of result may occur.

With a sextant in good order and adjustment the errors are small, and, if known, may be applied; but the heat of the sun may induce temporary errors, and shocks more serious and permanent errors, which, in some observations, will have a disastrous effect.

The ordinary observations are:—

*Sextant Observations.*

| | |
|---|---|
| For latitude .. .. | Meridian altitude of sun |
| | " " star |
| | Circum-meridian altitude of sun |
| | " " star |
| | Double altitude of sun or stars |
| For longitude .. .. | Time by single altitudes of sun |
| | " " " star |
| | " equal altitudes of sun |
| | " " " star |
| | Lunar Observations. |
| For true bearing and error of compass | By altitude of the sun |
| | By observed angular distance of a peak, or any other object from the sun |

*Telescope Observations:—*

| | |
|---|---|
| For longitude .. .. | Occultations of stars by the moon |
| | Eclipses of Jupiter's satellites |
| | Moon culminating stars with Transit Theodolite. |

With the exception of lunar observations, occultations of stars by the moon, and the eclipses of Jupiter's satellites, all these observations can

be taken with the transit theodolite. The instrument should be carefully levelled, care should be taken to remove the effects of parallax (*see* p. 26), and all observations must be taken in pairs with the face of the vertical circle to the left and right. The correction for level error (*see* p. 201) should be applied. In nearly all theodolites, observations taken with the face of the vertical circle to the left are altitudes, those taken with the face of the vertical circle to the right are zenith distances, and must therefore be subtracted from 90° to convert them into altitudes. The only difference in computing the results from theodolite observations and sextant observations is that in theodolite observations, taken face right and face left, there is no index error, and as the altitudes are measured direct they are not divided by 2 as in the case of the sextant when an artificial horizon is used. In all other respects the computations are exactly the same as those given in the examples.

## Observations of Heavenly Bodies with the Sextant.

Before any good results can be expected from sextant observations, the observer must be able to read the angles quickly and accurately; the only way to become proficient in doing this, is by practising with the instrument, especially at night, when the angles have to be read by the light of a lantern.

*Methods of obtaining accurate results.*—From the presence of the different sources of instrumental error mentioned on pp. 17 to 20, it is necessary, in order to ensure accurate results, that observations should be taken so as to eliminate them.

The precise methods will be described under the head of each observation, but the general principle is, that any altitudes for any purpose should be balanced by others taken in the opposite direction, either by waiting until the heavenly body has travelled to the opposite side of the meridian or by observing another on the opposite side taken immediately after, as in observations for time, or, in case of latitude, by observing another body on the opposite side of the zenith, as in meridian observations of a star for latitude.

Owing to the instrumental errors acting in different directions on the results in each case, the mean of those results will be the true time, or latitude, as the case may be.

For ordinary purposes of rough mapping, these niceties are not neces-

sary, but the traveller who wishes to obtain a good determination of an astronomical position must pay regard to them.

*To observe the altitude of the sun, using an artificial horizon.*—Fill the trough of the horizon with quicksilver, and put on the roof. Put down the suitable shades before the index and horizon glasses, set the index of the sextant to zero (0°); then with the artificial horizon between yourself and the sun, retire, looking into the horizon, until you see the sun's reflected image in it; look through the telescope collar, or plain tube, and horizon glass of the sextant at the sun itself; unclamp the index, and move it forward. This will bring the reflected image down, follow it with the eye until it slightly overlaps that in the horizon; clamp the index, and screw the inverting telescope into the collar (no time should be lost in doing this, or the sun's image may pass out of the field); then with the tangent screw make the contact perfect. It is always better to bring the object down into the horizon without the telescope; by so doing time is saved, and the unpractised observer is less likely to be mistaken as to which limb he is observing. The following rule will, however, prevent any such mistake:—In the forenoon, or when the sun is rising, if the lower limb is observed, the images are continually separating; if the upper limb is observed, they are continually overlapping; and the contrary in the afternoon, or when the sun is falling. *When the telescope is fitted with a dark shade to screw on to the eye end, it should always be used instead of the moveable shades.* If a roofed artificial horizon is used, the sides should be plainly marked, and it should be reversed at each set of three altitudes, *except when equal altitudes are observed* to find the error of the watch, in which case the observations must be taken with the same side of the roof towards the observer.* In placing the horizon on the ground it should have one of the glazed sides of the roof in a direct line with the sun, so that its sides cast no shadow. Any object seen in the mercury appears to be just as much below the horizontal plane as it really is above it; all angles, therefore, observed in an artificial horizon must be halved, *after* the index correction has been applied.

The foregoing remarks apply equally to stellar observations, the only difference being that no dark shades are required.

---

* This is by way of precaution against irregularities in the glass plates; and, with a roof of known excellence, is hardly necessary.

The usual method of picking up the image of the star in the artificial horizon, is to place the eye close to the artificial horizon, thus getting a large field of view, and as soon as the star is identified to draw back (keeping the eye on the star in the artificial horizon) into a comfortable position for observing; then bring the star down with the sextant, and make a contact with its reflection in the artificial horizon. In countries where there is a heavy fall of dew, it is always well to keep the artificial horizon covered with a light cloth during the intervals between taking sets of observations.

## Observations for Latitude.

The simplest observation is that for finding the *latitude by meridian altitude of the sun, star, or planet.* Some twenty minutes before apparent noon, when the sun is observed, or before the time of meridian passage of a star or planet, the observer should begin to take careful observations, reading the angles from time to time until the body has reached its greatest altitude; this will be the meridian altitude, and the time when it was taken will be apparent noon, if the sun has been observed.

### *Latitude by Meridian Altitude of Sun.*

July 17th, 1899.—At a place in Longitude by account 0° 48′ W., the meridian altitude of the $\underline{\odot}$ was observed in quicksilver to find the Latitude. Ther. 82°. Bar. 29·6 inches. Index error − 1′ 20″. Observer north of the $\odot$.

| | H. | M. | S. |
|---|---|---|---|
| Time of App. Noon, July 17th .. | 0 | 0 | 0 |
| W. Long. in Time .. .. .. .. .. | +0 | 3 | 12 |
| G. App. Time, July 17th .. | 0 | 3 | 12 |
| | ° | ′ | ″ |
| Declination (P. I. NA.) .. (Decreasing) | 21 | 12 | 20·9 N. |
| Correction .. .. .. .. .. | − | | 1·27 |
| Reduced Declination .. .. | 21 | 12 | 19·63 N. |
| | | | ″ |
| Variation in 1 hour (NA.) .. .. .. | | | 25·47 |
| | | | ·05 |
| Correction .. = | | | 1·2735 |

| | ° | ′ | ″ |
|---|---|---|---|
| Alt. $\underline{\odot}$ in quicksilver.. .. | 119 | 47 | 10 |
| Index error .. .. .. .. .. | − | 1 | 20 |
| 2) | 119 | 45 | 50 |
| | 59 | 52 | 55 |
| Refraction— Ther. 82°, Bar. 29·6 in | − | 0 | 32·4 |
| | 59 | 52 | 22·6 |
| Semidiameter .. .. .. .. .. | + | 15 | 45·8 |
| | 60 | 8 | 8·4 |
| Parallax .. .. .. .. .. .. | + | 0 | 4·2 |
| True Altitude.. .. .. .. .. | 60 | 8 | 12·6 |
| | 90 | 00 | 00 |
| Zenith Distance .. .. .. | 29 | 51 | 47·4 N. |
| Reduced Declination .. .. | 21 | 12 | 19·6 N. |
| Latitude .. .. .. .. .. .. | 51 | 4 | 7 N. |

*To Find Time of Meridian Passage of Star.*

When a star is observed for latitude, it is necessary to find the time of its meridian passage, either by tables (which give an approximate result), or, where accuracy is required, by the following method.

At a place in Longitude 30° E. required the mean time of the meridian passage of *a Tauri* (*Aldebaran*) on November 27th, 1899.

| | | | H. | M. | S. |
|---|---|---|---|---|---|
| (Case 1.) | | R. A. of *Aldebaran* + 24h.* = | 28 | 30 | 13·03 |
| | | Sidereal Time at Mean Noon = | 16 | 24 | 43·98 |
| | | Approx. M. T. = | 12 | 5 | 29·05 |
| | M. S. | | | | |
| | 12h. Retardation 1 57·95 | | | | |
| | 5·5m. ,, 0 0·9 | | – | 1 | 58·85 |
| | | | 12 | 3 | 30·20 |
| | | † 30° E. Long. (or 2h.) Acceleration | | + | 19·71 |
| | | Mean Time of Meridian Passage = | 12 | 3 | 49·91 |

* When the star's R. A. is less than the Sidereal Time at Mean Noon, increase it by 24 hours.

At a place in Longitude 60° W. required the mean time of the meridian passage of *a Scorpii* (*Antares*) on July 30th, 1899.

| | | | H. | M. | S. |
|---|---|---|---|---|---|
| (Case 2.) | | R. A. of *Antares* = | 16 | 23 | 16·97 |
| | | Sidereal Time at Mean Noon = | 8 | 31 | 37·48 |
| | | | 7 | 51 | 39·49 |
| | M. S. | | | | |
| | 7h. Retardation 1 18·81 | | | | |
| | 51·5m. ,, 8·44 | | – | 1 | 27·25 |
| | | | 7 | 50 | 12·24 |
| | | † 60° W. Long. (or 4h.) Acceleration | – | | 39·43 |
| | | Mean Time of Meridian Passage = | 7 | 49 | 32·81 |

† When the Longitude is West subtract the acceleration, when East add it.

*Latitude by Meridian Altitude of a Star.*

July 10th, 1899.—At a place in Longitude by account 70° 00′ W., the meridian altitude of *a Aquarii* was observed in quicksilver to find the

Latitude. Ther. 34°. Bar. 30 inches. Index error + 3′ 10″. Observer south of the star.

| | ° | ′ | ″ | |
|---|---|---|---|---|
| Alt. of ✳ in Quicksilver .. .. .. .. .. .. | 90 | 59 | 42 | |
| Index error .. .. .. .. .. .. .. .. .. | + | 3 | 10 | |
| 2) | 91 | 2 | 52 | |
| | 45 | 31 | 26 | |
| Refraction—Ther. 34°, Bar. 30 .. .. .. .. .. | − | 00 | 59·5 | |
| True Alt. .. .. .. .. .. .. .. .. .. .. | 45 | 30 | 26·5 | |
| | 90 | 00 | 00 | |
| Zenith Distance .. .. .. .. .. .. .. .. | 44 | 29 | 33·5 | S. |
| Declination .. .. .. .. .. .. .. .. .. | 0 | 48 | 19·6 | S. |
| Latitude .. .. .. .. .. .. .. .. .. .. | 45 | 17 | 53·1 | S. |

When the *meridian altitudes of a star above and below the Pole* can be observed, half the sum of the corrected altitudes gives the latitude at once, without any computation. When the *Pole Star* can be observed, the latitude is very easily found by the rule and tables given in the 'Nautical Almanac'; and as a fairly correct approximation without any calculation at all, the corrected altitude of the Pole Star is the latitude, if the star is observed when $\beta$ and $\zeta$, or still better, when $\beta$ and $\epsilon$ *Ursæ Minoris* appear to the eye to be in a line parallel with the horizon; a method which, as a rough observation, has the advantage of being independent of watch, tables, or 'Nautical Almanac.'

*Circum-meridian observations, or observations near the Meridian.*

A latitude by meridian altitude depends only on one altitude, the highest observed, and as this is liable to error, being only one observation, a more accurate result can be obtained *by taking sets of altitudes on either, or both sides of the meridian*, and noting the time corresponding to each altitude by a watch whose error on *apparent* time at place is known. These altitudes are taken in the manner previously described, and the observations should be commenced at about a quarter of an hour * before the heavenly body observed comes to the meridian, and may be continued until

* Very good results may be obtained from observations with a star half an hour or more from the meridian, if the local time be accurately known.

*Latitude by Altitudes of the Sun near the Meridian.*

July 12th, 1899, in approximate Latitude 12° 4′ S., Longitude 150° E., the following observations of ⊙ were taken with an artificial horizon, the index error of the sextant was − 55″, and the watch was 5h. 8m. 20s. slow of G.M.T. Ther. 78°. Bar. 30·2 inches; ⊙ N. of observer.

| | Times by Watch. | | | | Alt. Art. ⊙ Hor. | | |
|---|---|---|---|---|---|---|---|
| | H. | M. | S. | | ° | ′ | ″ |
| | 9 | 1 | 42 | | 111 | 22 | 50 |
| | | 4 | 25 | | | 20 | 40 |
| | | 4 | 50 | | | 19 | 0 |
| | | 5 | 11 | | | 18 | 40 |
| | | 5 | 33 | | | 18 | 0 |
| | | 6 | 0 | | | 16 | 50 |
| | | 6 | 23 | | | 16 | 0 |
| | | 6 | 49 | | | 14 | 40 |
| | | 7 | 18 | | | 14 | 10 |
| 9) | | 48 | 11 | 9) | | 160 | 50 |
| Mean | 9 | 5 | 21·2 | Mean | 111 | 17 | 52·2 |

| | H. M. S. |
|---|---|
| Noon ⊙ on Meridian, July 12th .. | 00 00 00 |
| Long. 150° 0′ E. in Time .. .. .. | −10 0 0 |
| G.D. of Transit (appt. Time), July 11th | 14 0 0 |

| | H. M. S. |
|---|---|
| Mean of the Times by Watch .. .. | 9 5 21·2 |
| Error of Watch for G.M.T., slow .. | + 5 8 20 |
| G.D. corresponding to the mean of the Observations, July 11th .. .. | 14 13 41·2 |

| | M. S. |
|---|---|
| Equation of Time (p. i. N.A.) .. .. | 5 14·17 |
| Corr. by Hourly Diff. N.A. ·339 × 14 = 4·746 .. .. .. | + 4·75 |
| Corr. Eq. T. + to apparent Time .. | 5 18·92 |

| | ° ′ ″ |
|---|---|
| Decl. at mean noon, p. ii. N.A., July 11th | 22 6 56·2 N. decreasing |
| Corr. by Hourly Diff. N.A... .. .. .. | − 4 43·7 |
| Decl. at mean of the Times .. .. .. | 22 2 12·5 N. |

To find what time the Watch will show at noon.

| | H. M. S. |
|---|---|
| Time of noon .. .. .. .. | 12 00 00 |
| Error of Watch on appt. time at place − | 3 3 1·1 |
| Time the *Watch* will show at noon = | 8 56 58·9 |

Take the difference between the time the Watch will show at noon and each of the times shown by the Watch when the Altitudes were observed, and the differences will be the Hour Angles.

To find the error of watch on App. Time by its error on Mean Time.

| | H. M. S. |
|---|---|
| App. Time of Noon | 00 00 00 |
| Eq. Time .. .. | + 5 18·9 |
| Local M.T. of Noon = | 00 5 18·9 |
| E. Long. in Time − | 10 0 0 |
| Corresponding G.M.T. | = 14 5 18·9 |
| Watch slow of G.M.T. | − 5 8 20 |
| Time watch will show at App. noon at place | 8 56 58·9 |
| Time of App. Noon | 12 00 00 |
| Watch slow on App. Time .. .. .. | = 3 3 1·1 |

| | ″ |
|---|---|
| Var. of Decl. in 1 hour.. | 19·94 |
| | 14·23 |
| | 5982 |
| | 3988 |
| | 7976 |
| | 1994 |
| | 60)283·7462 |
| Correction = | 4 43·7 |

Watch shows 8 h. 56 m. 58·9 s. at Noon.

| Watch Times. | Hour Angles. | Nos. Table X. | ☉'s Mer. Zenith Dist. nearly. |
|---|---|---|---|
| H. M. S. | M. S. | | |
| 9 1 42 | 4 43 | 43·7 | |
| 4 25 | 7 26 | 108·5 | ° ′ |
| 4 50 | 7 51 | 121·0 | Decl. noon .. 22 2 N. |
| 5 11 | 8 12 | 132·0 | Lat. (D.R.) .. 12 4 S. |
| 5 33 | 8 34 | 144·1 | |
| 6 0 | 9 1 | 159·6 | Mer. Z.D... .. 34 6 |
| 6 23 | 9 24 | 173·5 | |
| 6 49 | 9 50 | 189·8 | *N.B.*—The Meridian Zenith Distance is equal to the sum of the Latitude and Declination when they are contrary names; or their difference when of the same names. |
| 7 18 | 10 19 | 208·9 | |
| | | 9)1281·1 | |
| | Mean . | 142·3=N | |

| | ° ′ ″ | | |
|---|---|---|---|
| Lat. D.R. .. .. | 12 4 0 | Cos... .. | 9·990297 |
| Decl. .. .. .. | 22 2 12 | Cos... .. | 9·967054 |
| M.Z.D. .. .. | 34 6 | Cosec. .. | 0·251317 |
| N. .. .. .. | 142·3 | Log. .. | 2·153205 |
| | ″ 60)230·1 | Log. .. | 2·361873 |

Reduction = 3′ 50″·1

| | ° ′ ″ |
|---|---|
| Observed Altitude.. .. .. .. | 111 17 52·2 |
| Index error .. .. .. .. .. | − 0 55 |
| If taken in Quicksilver divide by 2) | 111 16 57·2 |
| | 55 38 28·6 |
| Corrected Refraction .. .. − | 37·8 |
| | 55 37 50·8 |
| Semidiameter.. .. .. .. + | 15 45·5 |
| | 55 53 36·3 |
| Parallax .. .. .. .. .. .. + | 4·8 |
| | 55 53 41·1 |
| Reduction .. .. .. .. .. | + 3 50·1 |
| Meridian Altitude .. .. .. | 55 57 31·2 |
| | 90 00 00·0 |
| Meridian Zenith Distance .. .. | 34 2 28·8 S. |
| Declination .. .. .. .. .. | 22 2 12·0 N. |
| Latitude .. .. .. .. .. .. | 12 0 16·8 S. |

*Latitude by Altitudes of a Star or Planet, near the Meridian.*

February 17th, 1899, the following observations were taken of *a Canis Majoris* (*Sirius*) when near the meridian to determine the Latitude, watch being 15 m. 30 sec. slow of G.M.T. Index error $-2'$. Approximate Latitude 51° 29′ N.; Long. 0° 3′ 12″ W. The star south of observer. Ther. 44°. Bar. 29·8 inches.

| | Times by Watch. H. | M. | S. | | Alt. in Art. Hor. ° | ′ | ″ | |
|---|---|---|---|---|---|---|---|---|
| | 8 | 45 | 38 | | 43 | 57 | 0 | |
| | 8 | 48 | 27·5 | | 43 | 54 | 0 | |
| | 8 | 52 | 20·5 | | 43 | 40 | 20 | |
| | 8 | 54 | 28 | | 43 | 37 | 40 | |
| 4) | | 200 | 54 | 4) | | 189 | 00 | |
| Mean .. = | 8 | 50 | 13·5 | | 43 | 47 | 30 | = Mean. |
| Error of Watch + | | 15 | 30 | Index error | | − 2 | 00 | |
| G.M.T. Feb. 17th = | 9 | 5 | 43·5 | 2) | 43 | 45 | 30 | |
| | | | | Obs. Alt. = | 21 | 52 | 45 | |

(*Continued on p.* 145.)

| | | H. | M. | S. |
|---|---|---|---|---|
| ✻'s Right Ascension... .. .. | = | 6 | 40 | 44·04 |
| Sidereal Time (P. ii. N. A.) .. | = | 21 | 48 | 58·95 |
| Approximate Time of Transit | = | 8 | 51 | 45·09 |
| Longitude in Time .. .. .. | = | | + | 12·8 |
| Approximate G.M.T. of Transit | | 8 | 51 | 57·89 |

| | | H. | M. | S. |
|---|---|---|---|---|
| Sidereal Time (P. ii. N. A.) .. | | 21 | 48 | 58·95 |
| Acceleration for 8 hours .. .. | | | 1 | 18·85 |
| 51 mins. .. .. | | | | 8·38 |
| 58 sec. .. .. | | | | ·16 |
| Mean ⊙'s Corrected R.A. .. .. | = | 21 | 50 | 26·34 |
| ✻'s R.A. .. .. .. .. .. .. | | 6 | 40 | 44·04 |
| Time of ✻'s Transit at Place .. | = | 8 | 50 | 17·7 |
| Longitude in Time .. .. .. | | | + | 12·8 |
| G.M.T. of Transit .. .. .. | | 8 | 50 | 30·5 |
| Error of Watch on G. M. T., slow | | − | 15 | 30 |
| Time by Watch of Transit .. | = | 8 | 35 | 00·5 |

Watch shows 8 H. 35 M. 00·5 S. at ✳'s Transit.

| Watch Times. | Differences. Mean Time.* | Differences. Sidereal Time. | Nos. from Table X. | Meridian Zenith Distance (nearly). |
|---|---|---|---|---|
| H. M. S. | M. S. | M. S. | | ° ′ ″ |
| 8 45 38 | 10 37·5 | 10 39·2 | 222·8 | |
| 8 48 27·5 | 13 27 | 13 29·2 | 357·0 | Decl. 16 34 50·3 S. |
| 8 52 20·5 | 17 20 | 17 22·8 | 592·9 | Lat. 51 29 00 N. |
| 8 54 28 | 19 27·5 | 19 30·7 | 747·0 | M.Z.D. 68 3 50·3 |
| | | | 4) 1919·7 | M. Z. D. = Decl. + Lat. when of different names; Decl. ∼ Lat. of the same name. |
| | | | N. = 479·9 | |

| | ° | ′ | ″ | | | |
|---|---|---|---|---|---|---|
| Latitude .. | 51 | 29 | 00 | Cos. .. | .. | 9·794308 |
| Declination | 16 | 34 | 50·3 | Cos. .. | .. | 9·981555 |
| M. Z. D. .. | 68 | 3 | 50·3 | Cosec. | .. | 0·032639 |
| N. .. .. | | | 479·9 | Log. | .. | 2·681151 |
| | ″ 60)308·8 | | | Log. | = | 2·489653 |
| Reduction | 5′–8″·8 | | | | | |

| | ° | ′ | ″ |
|---|---|---|---|
| Observed Altitude .. .. .. .. | 21 | 52 | 45 |
| Corrected Refraction .. .. .. .. .. | | −2 | 26·2 |
| | 21 | 50 | 18·8 |
| Reduction .. .. .. .. .. | | +5 | 8·8 |
| Meridian Alt. .. .. .. .. | 21 | 55 | 27·6 |
| | 90 | 00 | 00 |
| Meridian Zenith Dist. .. .. | 68 | 4 | 32·4 N. |
| Declination .. .. .. .. .. | 16 | 34 | 50·3 S. |
| Latitude .. .. .. .. .. .. | 51 | 29 | 42·1 N. |

* The differences of Mean Time are found by taking the difference between Watch Times, and the time of Transit, or Meridian passage, shown by Watch. When the mean time differences are great they must be converted into sidereal intervals by the table of Time Equivalents in the Nautical Almanac, or by Table XXXI.

N.B.—If the object be a Planet, the Declination and Right Ascension must be corrected for the G.D. by the Daily Diff. (Mean Time N. A.).

it has passed it by a like space of time. As the sun or star will be rising very slowly, the observations should be taken with deliberation, at about minute intervals. Should the sky become overcast, the observations on either side of the meridian can easily be reduced to the meridian altitude, and this circumstance adds considerably to the value of this class of observation, as the meridian altitude may be lost.

A latitude obtained by either the meridian or circum-meridian altitudes of the sun, or stars, which are all on one side of the zenith, *i.e.* all either to the north or south of the observer, is liable to considerable inaccuracy from the existence of instrumental errors.

To get a more certain result it is necessary to determine the latitude from the mean of results of observation of north and south stars, by which the instrumental errors are eliminated, and a very exact latitude obtained.

By north and south stars are meant stars which pass the meridian to the north and south of the observer's zenith. If their altitudes are nearly the same the exactitude of the result will be much increased, on account of the elimination of errors of refraction.

Latitudes by stars of the same altitude north and south afford the traveller a fair means of ascertaining the centering error of his sextant for the altitude observed, which is one half the difference of the latitude by the respective stars. When the latitude resulting from the star on the equatorial side of the observer is less than that from the star on the polar side, the correction for centering error will be minus, and *vice versâ*.

The following will illustrate the manner in which this observation is taken. Suppose that on the 1st of December, 1881, we wished to fix the position of the Society's Observatory in latitude, by north and south stars. On looking at the heavens we should see that $\gamma$ *Pegasi* and $\gamma$ *Cephei* were well situated for that purpose, and with these stars' right ascensions and the sidereal time at mean noon (taken from the 'Nautical Almanac'), we should find that $\gamma$ *Cephei* passed the meridian, to the *north*, at 6h. 51m. 24s., and $\gamma$ *Pegasi* to the south at 7h. 23m. 57s., thus leaving an interval of 32m. 33s. between the meridian passages. We should commence observing altitudes of $\gamma$ *Cephei* at 6h. 35m., and continue to do so until 7h. 5m.; we should then turn to $\gamma$ *Pegasi*, and continue our observations of that star until 7h. 40m. We should then compute the latitude by each set of observations, and take the mean of their results as the true latitude.

This observation may be taken, at the same place, at considerable intervals between the times of the two stars' meridian passage, and indeed days have sometimes been allowed to elapse before the second set of altitudes has been taken; the results, nevertheless, being quite satisfactory. When possible, however, it is better that the two observations should be taken consecutively, so as to ensure similar conditions of weather and refraction.

*Latitude by Double Altitude.*

When clouds prevent the altitude of the sun being observed at or near enough to noon to obtain the meridian altitude, or when the sun on the meridian is too high for observation in artificial horizon, the method known as double altitude may be very useful, *except when the declination approximates to the latitude, in which case this method should never be used.* This consists in observing the altitude of the sun (or star) at two times differing not less than one hour from each other. The latitude can be calculated from these with great exactness. The error of the watch on local time is only required approximately.

*Latitude by Double Altitudes of the Sun.*

July 18th, 1899. The following Altitudes of the ☉ were taken in quicksilver to determine the Latitude. Index error $-1' 20''$. On July 10th, the watch was 13·5 secs. slow of G. M. T. Approximate Latitude 51° 10′ N. Ther. 80°. Bar. 29·6 inches.

| | A.M. Times. | | | A.M. Alts. ☉ | | |
|---|---|---|---|---|---|---|
| | H. | M. | S. | ° | ′ | ″ |
| | 9 | 15 | 19 | 89 | 14 | 20 |
| | 9 | 16 | 17 | 89 | 30 | 40 |
| | 9 | 17 | 37 | 89 | 51 | 20 |
| 3) | | 49 | 13 | 3) | 96 | 20 |
| G. M. T. July 17th | 21 | 16 | 24·3 | 89 | 32 | 6·7 |

| | P.M. Times. | | | P.M. Alts. ☉ | | |
|---|---|---|---|---|---|---|
| | H. | M. | S. | ° | ′ | ″ |
| | 4 | 5 | 13 | 70 | 26 | 30 |
| | 4 | 6 | 05 | 70 | 10 | 40 |
| | 4 | 6 | 56 | 69 | 54 | 00 |
| 3) | | 18 | 14 | 3)210 | 31 | 10 |
| G. M. T. July 18th | 4 | 6 | 4·7 | 70 | 10 | 23·3 |

| | Month. | Day. | H. | M. | S. |
|---|---|---|---|---|---|
| Time of 1st Alt. .. .. | July | 17th | 21 | 16 | 24·3 |
| Time of 2nd Alt. .. .. | July | 18th | 4 | 6 | 4·7 |
| | | 2) | 6 | 49 | 40·4 |
| ½ Interval .. .. .. .. .. | | = | 3 | 24 | 50·2 |
| Time of 1st Obs. .. .. .. .. | | + | 21 | 16 | 24·3 |
| Middle Time at Place .. .. .. | | = | 0 | 41 | 14·5 |
| Error of Watch .. .. .. .. | | .. | | + | 13·5 |
| Middle Time, Greenwich, July 18th .. | | .. | 0 | 41 | 28 |

| | Month. | Day. | ° | ′ | ″ |
|---|---|---|---|---|---|
| ☉'s Declination. | July | 18th | 21 | 2 | 1·5 N. decreasing. |
| Corr. by Hourly Diff. 26″·36 × 0·7 | | | | | − 18·5 |
| Corrected Declination .. | | = | 21 | 1 | 43·0 N. |

| | | ° | ' | " | | |
|---|---|---|---|---|---|---|
| 1st Alt. in Art. Hor. .. .. .. | = | 89 | 32 | 6·7 | | |
| Index error .. .. .. .. .. | = | – | 1 | 20·0 | | |
| | 2) | 89 | 30 | 46·7 | | |
| | | 44 | 45 | 23·3 | | |
| Refraction = – 0' 54·7" ; Semid. = + 15' 45·8" ; Parallax = + 0' 5·9" } .. .. | = | + | 14 | 58·6 | | |
| 1st True Altitude .. .. .. .. | = | 45 | 00 | 21·9 | | |
| 2nd True Altitude .. .. .. .. | = | 35 | 19 | 2·5 | | |
| Sum of Altitudes .. .. .. .. | 2) | 80 | 19 | 24·4 | | |
| ½ Sum of Altitudes .. .. .. .. | = | 40 | 9 | 42·2 | | |
| Half Interval .. .. | | 3 H. | 24 M. | 50·2 S. | Sin. | 9·891785 |
| Declination .. | = | 21 | 1 | 43 | Cosin. | 9·970068 |
| Arc 1 .. .. | = | 46 | 40 | 48 | Sin. = | 9·861853 |
| Ar. Co. Log. of Sin. of Arc 1 .. .. .. | | | | | | 0·138147 |
| Half sum Alts. | = | 40 | 9 | 42·2 | Cos. | 9·883223 |
| Half diff. Alts. .. | = | 4 | 50 | 39·7 | Sin. | 8·926594 |
| Arc 2 .. .. | = | 5 | 5 | 17·5 | Sin. | 8·947964 |

| | | ° | ' | " | | |
|---|---|---|---|---|---|---|
| 2nd Alt. in Art. Hor. .. .. .. | = | 70 | 10 | 23·3 | | |
| Index error .. .. .. .. .. | = | – | 1 | 20·0 | | |
| | 2) | 70 | 9 | 3·3 | | |
| | | 35 | 4 | 31·6 | | |
| Refraction = – 1' 17·1" ; Semid. = + 15' 45·8" ; Parallax = + 0' 6·9" } .. .. | = | + | 14 | 30·9 | | |
| 2nd True Altitude .. .. .. .. | = | 35 | 19 | 2·5 | | |
| 1st True Altitude .. .. .. .. | = | 45 | 00 | 21·9 | | |
| Diff. of Altitudes .. .. .. .. | 2) | 9 | 41 | 19·4 | | |
| ½ Diff of Altitudes .. .. .. .. | = | 4 | 50 | 39·7 | | |
| .. .. .. .. .. .. .. | | | | | Sin. | 9·554893 |
| .. .. .. .. .. .. .. | | | | | Sec. | 0·163630 |
| Arc 3* .. .. | | 58 | 27 | 52·2 | Cos. | 9·718523 |
| | | | | | Repeat Sec. Arc 1 | 0·163630 |
| .. .. .. .. .. .. .. | | | | | Sin. | 9·809525 |
| .. .. .. .. .. .. .. | | | | | Cos. | 9·998446 |
| .. .. .. .. .. .. .. | | | | | Arc 2 Sec. | 0·001714 |
| Arc 4 .. | | 19 | 52 | 50 | Cos. = | 9·973315 |
| Arc 5 † | | 38 | 35 | 2·2 | Sec. | 0·106962 |
| | | | | | Sec. Arc 2 | 0·001714 |
| Latitude = | | 51 | 8 | 3 N. = | Cosec. = | 0·108676 |

N.B.—When the declination approximates to the latitude, this method should not be used.

* When Latitude and Declination are contrary names, the supplement of the Cosine is Arc 3.

† In Tropical Latitudes, when the Latitude and Declination are the same names, and the Latitude is less than the Declination, the sum of Arcs 3 and 4 will be Arc 5, otherwise their Difference is Arc 5.

## TIME.

*Measures of time.*—In these pages reference is made to *Mean*, *Apparent*, and *Sidereal* times, and it is possible that a few remarks on these different measures of time may be useful to those travellers who have not had the advantage of previous instruction. The first of these, *Mean time*, is the easiest to understand, as it is that usually shown by watches and clocks, and is reckoned by the average length of all the solar days throughout the year. For the purposes of everyday life, the day is divided into two periods of twelve hours each, and commences at midnight. This is called the *civil day*, to distinguish it from the astronomical day, which commences at *noon*, and is counted through the whole twenty-four hours from one noon to another.

*Apparent time* is time measured by the sun, as, for instance, the time shown by a sundial, and the difference between this time and the time shown by an ordinary watch, is called the *equation of time*, or the interval of time necessary to convert *Mean* time into *Apparent* time, or the contrary.

*Sidereal time* is measured by the interval occupied by a star between two consecutive passages over the same meridian, which is equal to 23h. 56m. 4·09s. of our ordinary, or mean time. It will thus be seen that the *sidereal* hour is 9·83s. shorter than the *Mean time* hour, and the *Sidereal* day 3m. 55·91s. shorter than the *Mean solar* day. Table XXXI. is for converting Mean time into Sidereal time, and Table XXXII. for converting Sidereal time into Mean time.

*To find a lost Date.*—It will sometimes happen that from one cause or another, a traveller may lose count of the day of the month, in which case (if provided with a sextant, artificial horizon, and 'Nautical Almanac' for the year), he may find it by one of the following methods:—

Find the latitude of the place by the meridian altitude of a fixed star (for this it is not necessary to know the day, as a star's declination varies but little). On the next day, at the same place, observe the meridian altitude of the sun, from which find the true altitude, and subtract it from 90° to get the sun's zenith distance; then with the latitude found by the star, and this zenith distance, the sun's declination may be found as

follows:—The difference between the latitude by star and the sun's zenith distance equals the sun's declination. With the declination thus found search page 1 for the month in the 'Nautical Almanac,' and opposite the declination that most nearly agrees with the declination found as above, is the day of the month.

This method cannot always be used in the tropics, *unless the traveller is provided with a transit theodolite,* as the meridian altitude of the sun will, at times, be too great to be measured with a sextant, when using an artificial horizon; neither can it be used with any degree of certainty at those periods just before or after the sun has obtained its greatest declination, viz., June 21st and December 21st.

Another simple method of finding the lost day, is to measure with a sextant the angular distance between the moon and one of the heavenly bodies whose distance from the moon is given in the lunar distance tables of the 'Nautical Almanac.' This observed distance must then be reduced to the *apparent distance* in the following manner:—When the sun is one of the objects, add the semi-diameters of the sun and the moon to the observed distance, but when a star or a planet is observed the moon's semi-diameter must be subtracted when the distance to the moon's far limb has been observed, but added when the near limb has been observed; the result in each case will be the apparent distance. Then (since the true and apparent distances cannot differ by more than the sum of the corrections of their altitudes), with the apparent distance found as above, search the 'Nautical Almanac' tables for the nearest given distance (of the same body) to it, opposite which will be found the day of the month. It must be remembered that the hours given in the lunar distance tables are counted from noon, when the astronomical day begins: thus July 18th, XVh., astronomical date, is July 19th, 3h. A.M., civil date.

## Observations for finding the Time and Longitude.

These are of two kinds. (1) Observations which have for their object to find the difference of longitude between the place of the observer and that of a place whose longitude is known.

(2) Observations to find the longitude directly, by the determination of Greenwich time astronomically, without the aid of a watch showing Greenwich time, or, as it is termed, absolutely.

The first require, when the time elapsed since the rate of the chronometer was last ascertained is great, a good and carefully-guarded timekeeper, and is known by the name of "meridian distance," or measuring the difference between the meridian of the place and that of the place where the chronometer was last rated, whose longitude is known. This method, when applicable, is by far the best, but in travelling requires that a continuous chain of observations should be taken from the time of leaving a place whose position is known; and as a watch, carried either by a pedestrian, or on horseback, rarely keeps an equable rate, the points where halts must be made for rating should not be more than five or six days apart.

The second method depends, in its various forms, almost entirely upon the rapidity of the moon's motion in the heavens, and, while it gives the longitude without reference to any previous observation, the result is always more or less rough, unless a great many observations are made on different nights, when the mean may approximate to the truth.

In any of these observations, with the exception of moon culminating stars, the true time at the place is required, and the method of finding this will first be described.

*To find Error of Watch by Absolute Altitudes.*

In finding local time by this observation it is not necessary that the longitude of the place should be known with any great degree of accuracy, as the Greenwich date, obtained by the longitude in time, is only used for correcting the elements taken from the 'Nautical Almanac,' and a considerable error in longitude would not produce any serious error in the declination or equation of time. The body should be observed as far from the meridian as possible, because, when nearly E. or W., errors, both of latitude and observation, produce the least effects on the hour angle. As a general rule, this observation should not be taken unless the sun or star is changing its altitude by *at least* 6′ in 1 m. of time. The readings of the barometer and thermometer should be noted, but for an approximate result are not necessary.

Sept. 24th, 1899, A.M., at a place in Lat. 43° 20′ N., approximate Long. 42° 43′ 35″ E.; the following altitudes of the ☉ were taken in an artificial horizon to find apparent and mean time, and the error of the watch on each time at the instant of observation. Index error − 7′ 30″.

| | | ° | ′ | ″ |
|---|---|---|---|---|
| Latitude.. .. .. .. .. .. | | 43 | 20 | 0 N. |

Ther. 61° Bar. 25 inches

**Time by Watch.**

| | | H. | M. | S. |
|---|---|---|---|---|
| | | 9 | 42 | 10 |
| | | 9 | 44 | 55 |
| | | 9 | 47 | 26 |
| | | 9 | 53 | 49 |
| | | 9 | 56 | 35 |
| | | 9 | 58 | 30 |
| | 6) | | 303 | 25 |
| Mean .. .. .. .. .. .. | | 9 | 50 | 34·17 |
| East Long. in time .. | − | 2 | 50 | 54·33 |
| G.M.T. Sept. 23rd .. .. | | 18 | 59 | 39·84 |

| | | H. | M. | S. |
|---|---|---|---|---|
| | | 24 | 0 | 0 |
| G.M.T., Sept. 23rd .. | = | 18 | 59 | 40 |
| What G.M.T. wants of Sept. 24th .. | = | 5 | 00 | 20 |

**Alt. of Sun's L.L. in Art. Hor.**

| | ° | ′ | ″ |
|---|---|---|---|
| | 75 | 22 | 40 |
| | 75 | 58 | 20 |
| | 77 | 26 | 30 |
| | 78 | 5 | 10 |
| | 78 | 29 | 20 |
| | 78 | 56 | 30 |
| | 6) 464 | 18 | 30 |
| Mean .. .. .. .. .. .. | 77 | 23 | 5 |
| Index Error .. .. .. .. .. | − | 7 | 30 |
| | 2) 77 | 15 | 35 |
| | 38 | 37 | 47·5 |
| Corr. Refraction .. .. .. | | − | 59·3 |
| | 38 | 36 | 48·2 |
| Semid. of Sun .. .. .. | + | 15 | 58·7 |
| | 38 | 52 | 46·9 |
| Parallax .. .. .. .. .. | | + | 6·6 |
| True Alt. .. .. .. .. .. | 38 | 52 | 53·5 |

| | | ′ | ″ |
|---|---|---|---|
| Mean refraction .. | | 1 | 13 |
| | | 60 | |
| | | 73 | |
| Bar. below 30 ins. = | | 5 | |
| | 30) | 365 | |
| | | − | 12·2 |
| Mean refraction .. | | 1 | 13·0 |
| | | 1 | 0·8 |
| Corr. for Ther... .. | | − | 1·5 |
| Corr. ref. .. .. = | | 0 | 59·3 |

(*Continued on p.* 154.)

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| Altitude .. | 38 | 52 | 53·5 | | |
| Latitude .. | 43 | 20 | 00 | Sec. | 0·138242 |
| Polar Dist. | 90 | 23 | 53·25 | Cosec. | 0·000011 |
| 2) | 172 | 36 | 46·75 | | |
| Half Sum.. | 86 | 18 | 23·37 | Cosin. | 8·809017 |
| Half Sum ∽ Alt. | 47 | 25 | 29·87 | Sin. | 9·867109 |
| | H. 1 | M. 58 | S. 22·2 † | Log. Sin. sqr. | 8·814378 |

| | ° | ′ | ″ |
|---|---|---|---|
| Sept. 24th. Decl. (N.A. p. ii.) | 0 | 28 | 45·70 S. |
| Correction by Hourly Diff. | − | 4 | 52·45 |
| Sun's Declin. .. | 0 | 23 | 53·25 S. |
| | 90 | 00 | 00 |
| Polar Dist. .. | 90 | 23 | 53·25 |

| | ″ |
|---|---|
| Var. in declination in 1 hour (N. A. p. i.) | 58·49 |
| | 5 |
| | 60) 292·45 |
| Correction .. .. .. = | 4 52·45 |

| | H. | M. | S. |
|---|---|---|---|
| Hour ∠ .. .. .. .. .. | 1 | 58 | 22·2 |
| | *24 | 00 | 00 |
| App. Time at Place .. .. | 22 | 1 | 37·8 |
| Eq. of Time.. .. .. .. .. | − | 7 | 54·97 |
| Mean Time at Place .. .. | 21 | 53 | 42·83 |

* If A.M., subtract the Hour Angle from 24 hours.

| | M. | S. |
|---|---|---|
| Sept. 24th Eq. of Time (N.A. p. ii.) .. | 7 | 59·29 |
| Corr. by Hourly Diff. .. .. | − | 4·32 |
| Red. Eq. Time—to App. T. .. | 7 | 54·97 |

| | S. |
|---|---|
| Var. in Eq. of Time in 1 hour (N.A. p. i.) .. | 0·864 |
| | 5 |
| Correction .. .. .. .. .. | 4·320 |

| | | H. | M. | S. |
|---|---|---|---|---|
| App. Time at Place .. .. .. .. .. .. | = | 22 | 1 | 37·8 |
| Mean of the Times + 12 h. .. .. .. .. | = | 21 | 50 | 34·17 |
| Watch slow of local App. Time.. .. .. .. | = | 0 | 11 | 3·63 |

| | H. | M. | S. |
|---|---|---|---|
| Mean time at place .. .. .. .. .. .. .. .. | 21 | 53 | 42·83 |
| Mean of the times + 12 h... .. .. .. .. .. | 21 | 50 | 34·17 |
| Watch slow of local M. Time .. .. .. .. .. | 0 | 3 | 8·66 |

† When no Log. Sin. sqr. table is available, the hour angle can be found as follows:—Take the Sum of the four Logs. as above and divide that Sum by 2; the result is the Log. Sin. of half the hour angle in degrees; from the table of Log. Sin., take out the Arc corresponding thereto, and multiply it by 2; convert the Arc into time by Table XXIX., and the result will be the hour angle.

When the error of the watch on Greenwich, *or on any other meridian*, and its daily rate are known, the longitude may be found by absolute altitudes of a heavenly body, as shown in the following examples:—

*Longitude by Chronometer, from Altitude of the Sun.*

April 19th, 1899, P.M. ☉ art. horizon. Index error – 1′ 50″; error of watch 14 secs. slow of G. M. T.

Latitude 51° 30′ 30″ N.

| | Time by Watch. | | |
|---|---|---|---|
| | H. | M. | S. |
| | 3 | 4 | 44 |
| | 3 | 6 | 18 |
| | 3 | 7 | 28 |
| | 3 | 8 | 32 |
| | 3 | 9 | 36 |
| 5) | | 36 | 38 |
| Mean.. | 3 | 7 | 19·6 |
| Error of Watch | | + | 14 |
| | 3 | 7 | 33·6 |
| Accumulated Rate.. | 0 | 0 | 0 |
| April 19th G. M. T. | 3 | 7 | 33·6 |

Ther. 68° Bar. 29 in.

| | Alt. of ☉ in Art. Hor. | | |
|---|---|---|---|
| | ° | ′ | ″ |
| | 70 | 38 | 10 |
| | 70 | 13 | 20 |
| | 69 | 54 | 20 |
| | 69 | 36 | 00 |
| | 69 | 19 | 10 |
| 5) | 349 | 41 | 00 |
| Mean | 69 | 56 | 12 |
| Index Error.. | – | 1 | 50 |
| 2) | 69 | 54 | 22 |
| | 34 | 57 | 11 |
| Corrected Refraction.. | – | 1 | 17·8 |
| | 34 | 55 | 53·2 |
| Semid. of Sun | – | 15 | 56·5 |
| | 34 | 39 | 56·7 |
| Parallax | + | | 6·9 |
| True Alt. | 34 | 40 | 3·6 |

(*Continued on p. 156.*)

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| Altitude .. .. .. .. | 34 | 40 | 3·6 | | |
| Latitude .. .. .. .. | 51 | 30 | 30 | Sec. | 0·205930 |
| Polar Dist.. .. .. .. | 78 | 45 | 27·3 | Cosec. | 0·008415 |
| 2) | 164 | 56 | 00·9 | | |
| Half Sum .. .. .. .. | 82 | 28 | 00·4 | Cosin. | 9·117607 |
| Half sum ∽ Alt .. .. | 47 | 47 | 56·8 | Sin. | 9·869697 |

| H. | M. | S. | | |
|---|---|---|---|---|
| * 3 | 8 | 3·44 | = Log. Sin. sqr. | 9·201649 |

| | ° | ′ | ″ | |
|---|---|---|---|---|
| Decl. (N.A. p. ii.) .. .. | 11 | 11 | 51·5 | N. increasing |
| Correction by Hourly Diff. | + | 2 | 41·2 | |
| Sun's Declin. .. .. .. | 11 | 14 | 32·7 | N. |
| | 90 | 00 | 00 | |
| Polar Dist. .. .. .. .. | 78 | 45 | 27·3 | |

| | H. | M. | S. |
|---|---|---|---|
| Hour ∠ .. .. .. .. .. .. .. .. | 3 | 8 | 3·44 |
| | † | 00 | 00 |
| App. Time at Place .. .. .. .. .. .. | 3 | 8 | 3·44 |
| Eq. of Time .. .. .. .. .. .. .. | | − | 54·44 |
| Mean Time at Place.. .. .. .. .. .. | 3 | 7 | 9·00 |
| G. M. T. .. .. .. .. .. .. .. | 3 | 7 | 33·6 |
| Long. in Time .. .. .. .. .. .. .. | | | 24·6 |

| | ° | ′ | ″ |
|---|---|---|---|
| Long. | | 6 | 9 W. |

| | M. | S. | |
|---|---|---|---|
| Eq. of Time (N.A. p. ii.) .. .. | 0 | 52·72 | increasing |
| Correction by Hourly Diff. .. .. | + | 1·72 | |
| Red. Eq. Time − to App. T. .. | 0 | 54·44 | |

| | ″ |
|---|---|
| Decl. Var. in 1 hour .. .. .. .. .. .. | 51·82 |
| | 3·11 |
| | 5182 |
| | 5182 |
| | 15546 |
| 60) | 161·1602 |
| | 2 41·2 |

| | S. |
|---|---|
| Eq. Time Var. in 1 hour .. .. .. .. .. | 0·554 |
| | 3·11 |
| | 554 |
| | 554 |
| | 1662 |
| | 1·72294 |

* See note p. 154.

† If A.M., subtract the Hour Angle from 24 hours.

*Longitude by Chronometer from Altitude of a Star.*

July 7th, 1899, *a Bootis* (*Arcturus*) West of Meridian. Index error −1′ 0″. Watch 50 secs. slow of G.M.T.

| | ° ′ ″ | Ther. | Bar. |
|---|---|---|---|
| Latitude.. .. .. .. .. .. .. | 51 4 24 N. | 62° | 29·7 in. |

| | Time by Watch. H. M. S. | | Alt. of Star in Art. Hor. ° ′ ″ |
|---|---|---|---|
| | 10 36 42 | | 78 27 30 |
| | 10 37 59 | | 77 58 00 |
| | 10 39 43 | | 77 26 00 |
| | 10 41 3 | | 77 4 20 |
| | 10 42 26 | | 76 35 30 |
| 5) | 197 53 | 5) | 387 31 20 |
| Mean .. .. .. .. .. .. .. | 10 39 34·6 | Mean .. .. .. .. .. .. .. | 77 30 16 |
| Error of Watch .. .. .. .. | + 50 | Index Error .. .. .. .. .. .. | − 1 00 |
| | 10 40 24·6 | 2) | 77 29 16 |
| Accumulated Rate .. .. .. .. | 0 0 0 | | 38 44 38 |
| G.M.T. July 7th .. .. .. .. .. | 10 40 24·6 | Corrected Refraction .. .. .. .. .. .. | − 1 10·3 |
| | | True Alt. .. .. .. .. .. .. | 38 43 27·7 |

When a Planet is observed the Altitude must be corrected for parallax.

| | ° ′ ″ | | | | H. M. S. |
|---|---|---|---|---|---|
| ✻'s True Alt. | 38 43 27·7 | | | ✻'s R.A. (N.A.).. | 14 11 6·05 |
| Latitude.. .. | 51 4 24 | Sec... .. | 0·201816 | | |
| Polar Dist. .. | 70 17 37 | Cosec. .. | 0·026211 | | ° ′ ″ |
| 2) | 160 5 28·7 | | | ✻'s Decl. (N.A.).. | 19 42 23 N. |
| Half Sum .. | 80 2 44·3 | Cosin. .. | 9·237702 | | 90 00 00 |
| Half Sum ∾ Alt. .. | 41 19 16·6 | Sin .. .. | 9·819730 | ✻'s Polar Dist. .. | 70 17 37 |
| H. M. S. † 3 28 27·4 = | | Log. Sin. sqr. | 9·285459 | | |

| | H. M. S. | | H. M. S. |
|---|---|---|---|
| ‖ ✻'s Hour ∠ .. .. .. .. .. | 3 28 27·4 | Sidereal Time (N.A. p. ii.).. .. | 7 0 56·69 |
| ✻'s R.A. .. .. .. .. .. .. | 14 11 6·05 | Acceleration for 10 hours .. .. | 1 38·56 |
| R.A. of Meridian .. .. .. .. | 17 39 33·45 | „ „ 40 minutes .. | 6 57 |
| Mean Sun's R.A. .. .. .. .. | 7 2 41·89 | „ „ 25 seconds .. | ·07 |
| | | Mean Sun's R.A... .. .. .. | 7 2 41·89 |
| Mean Time at Place .. .. .. | 10 36 51·56 | | |
| G.M.T. .. .. .. .. .. .. .. | 10 40 24·60 | | ° ′ ″ |
| Long. in Time .. .. .. .. | 3 33·04 | | 0 53 15 W. |

‖ N.B.—When the Star is West of the Meridian, add the hour ∠ to the Star's R.A.; when to the East, subtract the Star's hour ∠ from its R.A. (increased, if necessary, by 24 hours); the result is the R.A. of the Meridian; from the R.A. of the Meridian (increased, if necessary, by 24 hours), subtract the R.A. of the Mean Sun, and the result will be the Mean Time at place.

† See note p. 154.

*Equal Altitudes of the Sun, Star, or Planet.*—In consequence of instrumental errors, time obtained by absolute altitudes is sometimes considerably in error.

To eliminate these, it is necessary to observe *equal altitudes* of the heavenly body—that is, to note the time when it is at the same altitude east, and when west, of the meridian.

This necessitates a halt of some hours, and, in the case of a star, observation in the night and early morning; but when time and circumstances are favourable, the result will always be more satisfactory than absolute altitudes.

This observation must be commenced when the heavenly body observed is three or four hours east of the meridian. Having placed the artificial horizon in its proper position, bring down the reflected image of the object with the sextant until it is in contact with the image in the horizon, then advance the index until it points to a whole degree—for example, 40°—and, looking through the telescope at the image reflected by the sextant mirrors, wait until it attains this altitude, note the time, advance the index 20′, to 40° 20′, and wait until this altitude is reached, note the time; again advance the index 20′, to 40° 40′, and in like manner wait till this altitude is attained, note the time. Repeat this operation as often as convenient; nine such observations will be ample. The heavenly body observed will, of course, at some time, have the same altitude when it is west of the meridian, and this will be the case when it is *about* the same interval, in time, from it. The observer must therefore watch until the last altitude taken is again furnished, note the time when this takes place, and couple it in his note-book with the time when the heavenly body had the same altitude on the other side of the meridian; move the index *back* 20′ and wait until this altitude is furnished, note the time, and again couple it with the time when the same altitude was before taken, and so on through the set, moving the index *back* after each sight by the exact amount it was moved forward when the object was east of the meridian, or rising. When an artificial horizon is used, equal altitudes of a star should be taken in preference to those of the sun, for as the images of the star are but small luminous points, there cannot be any great error in the observation if they are made to touch, while in the case of the sun, exact contacts are by no means so easy to make. The computation necessary to find the error of the watch, by equal altitudes

of a star, is extremely short and simple, and therefore best suited to the ordinary traveller. As the declination of a star may, for the purposes of this observation, be considered constant, there is no necessity to compute the equation of equal altitudes, which must always be done in the case of the solar observation. The number of minutes by which the index is to be advanced or put back must depend on the rapidity with which the heavenly body is changing its altitude; it has here been mentioned as 20′ to illustrate the manner in which the observation is taken; but no general rule can be given for this; it is a matter in which the observer must use his own discretion. The *same side* of the roof of the artificial horizon must always be used for both sets of observations.

*To find the Error of the Watch by Equal Altitudes of the Sun.*

July 25th, 1899, in Lat. 51° 4′ 24″ N., Long. 0° 48′ W., the ⊙ had equal altitudes at the the following times. Required the error of watch.

| Times of ⊙'s Equal Alts. by Watch. A.M. H. M. S. | P.M. H. M. S. |
|---|---|
| 9 38 40 | 2 39 19 |
| 9 41 8 | 2 36 52 |
| 9 43 37 | 2 34 24 |

| | H. | M. | S. | | H. | M. | S. |
|---|---|---|---|---|---|---|---|
| 3) | | 123 | 25 | 3) | | 110 | 35 |
| Mean of A.M. Times | 9 | 41 | 8·3 | Mean of P.M. Times | 14 | 36 | 51·6 |
| | | | | Mean of A.M. Times | 9 | 41 | 8·3 |
| | | | | 2) | 24 | 17 | 59·9 |
| | | | | Middle Time by Watch .. .. | 12 | 8 | 59·9 |

| | Year. | Month. | Day. | H. | M. | S. |
|---|---|---|---|---|---|---|
| | 1899 | July | 25 | 0 | 0 | 0 |
| Longitude in Time .. .. .. .. | | | | + | 3 | 12 |
| Greenwich Date at Apparent Noon, July 25th.. .. .. .. .. .. | | | = | 0 | 3 | 12 |

| | Month. | Day. | ° | ′ | ″ | |
|---|---|---|---|---|---|---|
| ⊙'s Declination (p. i. N. A.) | July | 25 | 19 | 39 | 41·4 | N. decreasing. |
| Corr. for Hourly Diff. (N. A.) .. .. | | | | − | 1·6 | |
| Corrected Declination .. .. .. | | | 19 | 39 | 39·8 | N. |
| | | | 90 | 00 | 00 | |
| North Polar Distance .. .. .. | | | 70 | 20 | 20·2 | increasing. |

| | M. | S. |
|---|---|---|
| Equation of Time (p. i. N. A.) .. .. | 6 | 17·13 |
| Corr. for Hourly Diff. (N. A.) .. .. | 0 | 0 |
| Corrected Equation of Time + to Apparent Time .. .. .. .. | 6 | 17·13 |

| | | ″ |
|---|---|---|
| Hourly Diff. in Declination (N. A.) .. | .. | 32·34 |
| Half Elapsed Time .. .. .. .. | × | 2·46 |
| | | 19404 |
| | | 12936 |
| | | 6468 |
| | C = | 79·5564 |

| | H. | M. | S. |
|---|---|---|---|
| Mean of P.M. Times .. .. .. .. .. | 14 | 36 | 51·6 |
| " A.M. " .. .. .. .. .. | 9 | 41 | 8·3 |
| Difference .. .. .. .. .. .. .. 2) | 4 | 55 | 43·3 |
| Half Elapsed Time .. .. .. .. .. | 2 | 27 | 51·6 = $h$ |

| | | | | | |
|---|---|---|---|---|---|
| C .. | | 79″·56 | Log. .. | 1·900695 | |
| Lat. | 51° 4′ | 24″ | Tang. .. | 0·092767 | |
| $h$ .. | 2h. 27m. | 52s. | Cosec. .. | 0·220872 | |

A. 163″·8 = Log. = 2·214334

| | | |
|---|---|---|
| | | ″ |
| A .. | .. | 163·8 |
| B .. | − | 37·8 |
| Equation of Equal Altitudes .. | | 126·0 |

2′ 6″ = 8·4 secs.

| | H. | M. | S. |
|---|---|---|---|
| If the Watch is right for Apparent Time,* it will show .. .. .. .. .. .. .. | 12 | 0 | 0 |
| But it shows .. .. .. .. .. .. .. | 12 | 9 | 8·3 |
| Therefore it is Fast for App. Time at Place | 0 | 9 | 8·3 |

| | | | | | |
|---|---|---|---|---|---|
| C .. | | 79″·56 | Log. .. | 1·900695 | |
| Decl. | 19° 39′ | 40″ | Tang... | 9·553016 | |
| $h$ .. | 2h. 27m. | 52s. | Cotang. | 0·123411 | |

B. 37″·8 = Log. = 1·577122

| | H. | M. | S. |
|---|---|---|---|
| Applying Equation of Time to .. .. .. | 12 | 0 | 0 |
| Equation of Time .. .. .. .. .. .. .. | + | 6 | 17·13 |
| If right for M. T., at App. Noon the Watch would show .. .. .. .. .. .. .. | 12 | 6 | 17·13 |
| But it shows .. .. .. .. .. .. .. | 12 | 9 | 8·30 |
| Therefore Watch Fast on M. T. at Place .. | 0 | 2 | 51·17 |

A + B, when the Lat. and Decl. are contrary names; and A − B when they are the same name, is the Equation of Equal Altitudes.

| | H. | M. | S. |
|---|---|---|---|
| Middle Time by Watch .. .. .. .. .. .. .. | 12 | 8 | 59·9 |
| *Equation of Equal Altitudes .. .. .. .. .. | | + | 8·4 |
| Time by Watch at Apparent Noon .. .. .. | 12 | 9 | 8·3 |

| | H. | M. | S. |
|---|---|---|---|
| Applying Long. in Time to M. T. at App. Noon .. .. .. .. .. .. .. .. .. | 12 | 6 | 17·13 |
| Longitude in Time .. .. .. .. .. .. .. | + | 3 | 12 |
| Corresponding G. M. T... .. .. .. .. .. | 12 | 9 | 29·13 |
| But Watch shows .. .. .. .. .. .. .. | 12 | 9 | 8·30 |
| Watch Slow on G. M. T. at Apparent Noon | 0 | 0 | 20·83 |

* + when ☉'s P. D. is increasing, but − when ☉'s P. D. is decreasing.

NOTE.—When the Lat. and Decl. are the same name, and the Declination greater than the Latitude, B may be greater than A. When the Latitude is equal to, or exceeds the Declination, A will be greater than B.

*To find the Error of the Watch by Equal Altitudes of a Star.*

June 30th, 1899, *a Scorpii* (*Antares*) had equal altitudes at the undermentioned times. Longitude 26° 40″ E.

| | East Times. H. | M. | S. | | H. | M. | S. | | West Times. H. | M. | S. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 48 | 30 | | | | | | 10 | 57 | 54 |
| | 4 | 49 | 31 | | | | | | 10 | 59 | 3 |
| | 4 | 53 | 2 | | | | | | 11 | 1 | 11 |
| | 4 | 55 | 14 | Star East of Meridian.. .. .. .. .. .. | 4 | 52 | 31·4 | | 11 | 4 | 48 |
| | 4 | 56 | 20 | Star West ,, .. .. .. .. .. | 11 | 1 | 46 | | 11 | 5 | 54 |
| 5) | | 262 | 37 | 2) | 15 | 54 | 17·4 | 5) | 55 | 8 | 50 |
| | 4 | 52 | 31·4 | Time by Watch of Star's transit .. = | 7 | 57 | 8·7 | | 11 | 1 | 46 |

| | | H. | M. | S. |
|---|---|---|---|---|
| Sidereal Time at Mean Noon (p. ii. N.A.) .. .. .. .. .. .. .. .. | | 6 | 33 | 20·77 |
| Acceleration (Table XXXI.) for Longitude in time + if West Longitude, – if East Longitude .. .. .. .. .. .. .. .. .. .. | | | – | 17·53 |
| Reduced Sidereal Time.. .. .. .. .. .. .. .. .. .. | = | 6 | 33 | 3·24 |
| Star's R.A., which will also be R.A. of Meridian.. .. .. .. .. .. | = | 16 | 23 | 17·15 |
| Star's R.A. (+ 24 hours if necessary) – Reduced Sidereal Time .. .. .. | = | 9 | 50 | 13·91 |
| Further reduced by Retardation (Table XXXII.) .. .. .. .. { 9 hours = 1 m. 28·47 s.; 50 m. = 8·19; 14 secs. = ·04 } .. | = | – | 1 | 36·70 |
| Mean Time of Star's Transit .. .. .. .. .. .. .. .. | = | 9 | 48 | 37·21 |
| Time by Watch of Star's Transit .. .. .. .. .. .. .. | = | 7 | 57 | 8·7 |
| Error of Watch slow on Local Time .. .. .. .. .. .. .. | = | 1 | 51 | 28·51 |

*Equal Altitudes of a Star on the same side of the Meridian, on different nights.*—Observe the altitude of a star at any time, note the time and the altitude. After an interval of some days—for example, four days—set the index to the altitude noted, and take the time when the star attains it; then, as a star comes to the meridian exactly 3m. 55·91s. earlier every day, multiply this interval by the number of days elapsed, and subtract the product from the time when the first altitude was taken; the result will be the time the watch should show. Any difference between this result and the time the watch shows is the error for the interval, which, divided by the number of days, gives its daily rate; thus, if a watch showed 9h. 50m. 8s., when an observation of a star was

taken June 20th, and on June 24th showed 9h. 34m. 10s., when the same star had the same altitude, its daily rate would be 3·6s. losing:—

| | H. | M. | S. |
|---|---|---|---|
| 1st time by watch .. .. | 9 | 50 | 8 |
| 3 m. 55·91 sec. × 4 = | – | 15 | 43·6 |
| Time watch should show | 9 | 34 | 24·4 |
| 2nd time by watch.. .. | 9 | 34 | 10 |
| Losing in 4 days .. .. | | | 14·4 ∴ daily rate 3·6 sec. |

This observation should only be taken when the star has a considerable altitude, so as to reduce the errors caused by refraction, and can only be used when a halt of some days is made, as any change in latitude would be followed by a change of altitude.

## *Rate.*

It is but of little practical use to find the precise time of your observation unless it is transferred to the watch. By taking the difference between the time resulting from the observations, and that shown by the watch, the error of the latter is found.

The true time of any subsequent, or previous observation taken within a short time of the observation for time, can then be found by applying this known error to the watch time.

If, however, the time is required some days later, it is necessary to know the rate of the watch, and this is obtained by repeating the observation for time in the same spot after a few days, when the difference of the errors, divided by the time elapsed between the observations, will be the rate of the watch.

| | H. | M. | S. | |
|---|---|---|---|---|
| Thus, Error of Watch at Ujiji on 24th Sept., 8 A.M., was | 1 | 14 | 23 | slow |
| ,, ,, ,, 29th Sept., 8 A.M., was | 1 | 15 | 17 | ,, |
| Difference | | | 5) 54 | |
| Rate of Watch = | | | 10·8 | losing |

Then, supposing that observations for longitude, say, by occultations, were obtained on the 26th without being able to obtain observations for time on the same day, the time can be found by applying the rate to the previous error, thus:—

| | H. | M. | S. | H. | M. | S. |
|---|---|---|---|---|---|---|
| Watch showed at time of observation of occultation about 10 P.M. | | | | 9 | 1 | 50 |
| Error of Watch on 24th .. .. .. .. .. .. = | 1 | 14 | 23 | | | |
| 2·6 days' rate = 28·1 secs. losing .. .. .. | | | 28·1 | | | |
| Error of Watch at time of occultation .. .. .. | 1 | 14 | 51·1 .. | 1 | 14 | 51·1 |
| True time at observation, 26th | | | | 10 | 16 | 41·1 |

*Longitude by Meridian Distance.*

The difference of longitude of two places is the difference of time between them at the same instant.

If therefore you can transport the time at one place, by means of a watch, to another place, and obtain the true time at that second place, the difference of those times is the difference of longitude between the two places.

This is accomplished in practice, by finding the errors of the watch at the two places, either by absolute, or equal altitudes, and the rate, in any case at one of them, though it is better to find it at both, and take the mean.

Rules.—The time at the place where the first observations were taken must be reduced by the mean rate and the interval to the same instant of time as when the observations were taken for error at the second place of observation. This is done by multiplying the mean rate by the interval of time (expressed in days and decimals of a day) that has elapsed between the last observation for error at the first station, and the first observation at the last station.

*Error slow.*—Suppose a case where the error of the watch at both stations was found to be slow on the local time, then, after reducing the error of the watch, as above, from the first station to the second, if the watch is less slow at the second station, the meridian distance will be West, because we have, by travelling to the West, reduced a slow error on the local time of the first station. On the other hand, if the error at the second station, after the above reductions, should be more slow, then the meridian distance will be East, because by travelling East we have increased a slow error on the local time of the first station.

*Error fast.*—If the error of the watch at both stations is fast, then (after reducing the time of the first station to the second station, as directed above) if the watch is less fast at the second station, the

meridian distance will be East, because we must have travelled East to reduce a fast error on the local time of the first station; but, if it is more fast at the second station, the meridian distance will be West, because we must have travelled West to increase a fast error on the local time of the first station.

*Fast and slow errors combined.*—When the watch at first station has a slow error on local time, and a fast error at second station, the meridian distance will be West, because we must have travelled West to have changed a fast error on the local time of the first station to a slow one at the second station; and when the watch at first station has a fast error on local time, and a slow error at the second station, the meridian distance will be East, because we must have travelled East to change a fast error on local time at the first station to a slow one at the second station.

If provided with a compass, a traveller should, in all cases, know if he had been making Easting or Westing.

The following are examples of these three cases:—

*Example* 1.

| | H. | M. | S. | |
|---|---|---|---|---|
| Error of Watch at Mombasa, 8 A.M., 14th of July .. .. | 2 | 18 | 32 | slow. |
| " " " 9 A.M., 20th " .. .. .. | 2 | 17 | 14 | " |
| Interval 6·04 days  Difference = | | 1 | 18 | |
| 6·04) | | | 78 | |
| Daily rate = | | | 12·91 | gaining. |

| | H. | M. | S. | |
|---|---|---|---|---|
| Error of Watch at Taveta, 4 P.M., July 25th .. .. .. .. | 2 | 8 | 5 | slow. |
| " " " 8 A.M., July 30th .. .. .. .. | 2 | 6 | 48 | " |
| Interval 4·67 days.  Difference = | | 1 | 17 | |
| 4·67) | | | 77 | |
| Daily rate .. .. .. .. .. .. .. .. .. .. .. .. .. = | | | 16·5 | gaining. |
| Former daily rate .. .. .. .. .. .. .. .. .. .. .. = | | | 12·9 | " |
| | | | 2)29·4 | |
| Mean daily rate .. .. .. .. .. .. .. .. .. .. | | | 14·7 | " |

| | H. | M. | S. | |
|---|---|---|---|---|
| Error of Watch at Mombasa, July 20th, 9 A.M. .. = | 2 | 17 | 14 | slow. |
| 5·3 days' mean rate .. .. .. .. .. .. .. .. .. .. .. .. .. − | | 1 | 18 | gaining. |
| Error of Watch at Mombasa, July 25th, 4 P.M. .. = | 2 | 15 | 56 | slow. |
| " " Taveta, " " .. = | 2 | 8 | 5 | |
| Meridian distance, or difference of Longitude between Mombasa and Taveta .. .. .. .. .. .. .. = | | 7 | 51 | = 1° 57′ 45″ |

and as the watch is less slow at Taveta than at Mombasa, Taveta is west of Mombasa.

| | | ° | ′ | ″ | |
|---|---|---|---|---|---|
| The Longitude of Mombasa being .. .. .. .. .. .. | | 39 | 40 | 00 | E. |
| Meridian distance, west.. .. .. .. .. .. .. .. .. | | 1 | 57 | 45 | W. |
| Longitude of Taveta .. .. .. .. .. .. .. .. | = | 37 | 42 | 15 | E. |

Here we have supposed the rate to be obtained at both places. If, however, it was only ascertained at one end, that rate would have to be used. In the case supposed the result would be a difference of 10 seconds in the determination of the longitude of Taveta, or 2′ 30″ of longitude.

*Example* 2.

| | | H. | M. | S. | |
|---|---|---|---|---|---|
| June 15th, 9 A.M.—Error of watch at Manos.. .. .. | | 3 | 56 | 20 | fast. |
| June 20th, 3.56 P.M. ,, ,, ,, .. .. .. .. | | 3 | 58 | 10 | ,, |
| Difference | = | | 1 | 50 | |

```
          days.  secs.
Interval: 5·29 ) 110·0000 (20″·79 = daily rate gaining.
                 105 8
                 ------
                   4 200
                   3 703
                   -----
                     4970
                     4761
```

| | | H. | M. | S. | |
|---|---|---|---|---|---|
| June 27th, 4 P.M.—Error of watch at Concacão .. .. | | 3 | 48 | 5 | fast. |
| July 3rd, 8 A.M. ,, ,, ,, .. .. .. | | 3 | 49 | 58 | |
| Difference | = | | 1 | 53 | |

```
          days.  secs.
Interval: 5·66 ) 113·0000 (19″·96 daily rate gaining.
                 56 6
                 -----
                 5640
                 5094
                 -----
                  5460
                  5094
                  -----
                   3660
                   3396
```

| | ″ |
|---|---|
| Daily rate at Manos .. .. .. .. .. .. | 20·79 |
| ,, ,, Concacão .. .. .. .. .. | 19·96 |
| | 2)40·75 |
| Mean daily rate = | 20·37 |

| | H. | M. | S. |
|---|---|---|---|
| Error of watch at Manos, June 20th, 3.56 P.M. .. .. .. .. .. .. .. .. | 3 | 58 | 10 fast. |
| 7 days' mean rate gaining .. .. .. .. .. .. .. .. .. | + | 2 | 22·59 |
| Error of watch at Manos, June 27th, 4 P.M. .. .. .. .. .. .. .. .. .. | 4 | 00 | 32·59 |
| ,, ,, Concacão ,, ,, .. .. .. .. .. .. .. .. .. | 3 | 48 | 05 fast. |
| Meridian distance or difference of longitude between Manos and Concacão | 0 | 12 | 27·59 |

As the watch is less fast at Concacão than at Manos, Concacão is East of Manos.

| | ° | ′ | ″ |
|---|---|---|---|
| Longitude of Manos .. .. .. .. .. | 60 | 00 | 00 W. |
| Meridian distance East .. .. .. .. .. | 3 | 6 | 54 E. |
| Longitude of Concacão .. .. .. .. .. | 56 | 53 | 6 W. |

*Example* 3.

| | H. | M. | S. |
|---|---|---|---|
| May 12th, at 8.30 A.M., at Bandar Abas, watch .. .. | 1 | 10 | 20 fast. |
| May 16th, at 4.10 P.M... .. .. .. .. .. .. .. .. .. | 1 | 9 | 52 ,, |
| Difference = | 0 | 0 | 28 |

```
          days.   secs.
Interval: 4·33 ) 28·0000 ( 6″·46 = daily rate losing.
                 25 98
                 -----
                  2 020
                  1 732
                  -----
                   2880
                   2598
```

| | H. | M. | S. |
|---|---|---|---|
| May 21st, at 3.30 P.M., at Forg, watch .. .. .. .. .. | 1 | 15 | 2 fast. |
| May 25th, at 8.30 A.M. ,, ,, .. .. .. .. .. | 1 | 14 | 41 ,, |
| Difference = | 0 | 0 | 21 |

```
          days.   secs.
Interval: 3·71 ) 21·0000 ( 5″·66 = daily rate losing.
                 18 55
                 -----
                  2 450
                  2 226
                  -----
                   2240
```

| | secs. |
|---|---|
| Daily rate at Bandar Abas .. .. .. .. | 6·46 |
| ,, ,, Forg .. .. .. .. .. .. | 5·66 |
| 2 ) | 12·12 |
| Mean daily rate = | 6·06 |

| | H. | M. | S. | |
|---|---|---|---|---|
| Error of watch at Bandar Abas at 4.10 P.M., May 16th .. .. .. | 1 | 9 | 52 fast. | |
| 5 days' mean rate .. .. .. .. .. .. .. | | – | 30·3 losing. | |
| Error of watch at Bandar Abas at 3·30 P.M., May 21st .. .. .. | 1 | 9 | 21·7 | |
| ,, ,, Forg at 3.30 P.M., May 21st .. .. .. .. .. | 1 | 15 | 2 | ° ′ ″ |
| Meridian distance or diff. of long. between Bandar Abas and Forg | 0 | 5 | 40·3 | = 1 25 4·5 |

As watch is more fast at Forg than at Bandar Abas, Forg is West of Bandar Abas.

| | ° | ′ | ″ |
|---|---|---|---|
| Longitude of Bandar Abas .. .. .. .. | 56 | 18 | 00 E. |
| Meridian distance West .. .. .. .. .. | 1 | 25 | 4·5 W. |
| Longitude of Forg .. .. .. .. .. = | 54 | 52 | 55·5 E. |

This method can be used at *any part of a journey* to measure the differences of longitude between two places. If the longitude of one of the places has been fixed by any of the absolute methods, the longitude of the other is known at once. If not, the longitude of either of the places may be fixed hereafter, and the longitudes of the places whose meridian distances have been measured will be in connection with it, and not be scattered about with large individual errors, as would be the case were they determined separately by one or two observations.

### *Longitude by the Occultation of a Star.*

This is the best of the absolute methods of finding longitude, when a sextant or theodolite is available for ascertaining the local time. The following describes the manner in which the observation is taken:—

The moon in its monthly revolutions round the earth frequently passes between the earth and a fixed star so as to intercept a spectator's view of the latter; the disappearance of a star from this cause is called an *immersion*, and its reappearance from behind the moon is called an *emersion*. A list of these phenomena is given in the 'Nautical Almanac,' with the limits in latitude beyond which a star cannot be occulted by the moon. As the elements refer to the moon and star, as they would be seen from the earth's centre, they serve equally for all places on the earth's surface.

Should the explorer's position in latitude be central as regards the limits given in the 'Nautical Almanac,' he will probably be able to observe the occultation, but it by no means follows, because his latitude is included

within the parallels given in the 'Nautical Almanac,' that the occultation will therefore be visible to him. The first point for him to consider is whether the moon will be above the horizon, at the time of conjunction. This can easily be determined by applying the assumed longitude in time to the G.M.T. of conjunction in R.A. of the moon and star, which he will find among the elements of occultations in the 'Nautical Almanac,' *adding* the longitude in time if it be *East*, and *subtracting* if it be *West*; and then by reference to the time of the moon's meridian passage (p. iv. N.A.), and her semi-duration above the horizon (Table VIII.), he can ascertain whether that time will include the period of occultation, and whether the occultation will take place in daylight, in which case it cannot be observed, if the star, as is most frequently the case, is one of small magnitude. The general effects of parallax must be taken into consideration, as parallax will accelerate the occurrence of the occultation when the moon is east of the meridian, and retard it when west; and under certain conditions this acceleration or retardation may amount to more than an hour and a half, or it may so affect the apparent relative positions of the moon and star that the occultation may not take place at all at that station. To prevent loss of time and disappointment, the circumstances of the occultation should be computed beforehand by the simple method given, p. 171 *et seq*. The traveller will then know whether the occultation will take place at his station, the approximate local mean time of immersion and emersion, and the position on the moon's limb where the star will disappear and reappear.

If a traveller neglects to compute the circumstances of an occultation he wishes to observe, he must compute the local time of the phenomenon by applying the assumed longitude in time to the G.M.T. of conjunction in R.A. of the moon and star, which he will find among the elements of occultations in the 'Nautical Almanac,' *adding* the longitude in time if it be *East*, and *subtracting* if it be *West*. An hour before the time so found, he should point his telescope to that limb of the moon by which the star will be occulted; it is necessary to take this precaution as his time may be in error, and the effects of parallax may accelerate or retard the occultation at his station according as the moon is east or west of the meridian. The moon will be seen to approach the star from west to east, until its eastern limb will reach the star and occult it; note the instant when this takes place. After a certain interval the star will re-

appear on the other side of the moon; note this time also. Either of these observations is sufficient to determine the G M T., and thence the longitude, in the manner shown in the example. When the star is occulted by the moon's dark limb, the observation will afford most decisive results. At or near full moon a star occulted by the bright limb is not so easy an observation. The description of a telescope suitable for this observation is given on pp. 7, 8. The example given is computed by Raper's rule and tables. It will be observed that several of the logs can be taken at one opening of the book, and as only four places of decimals are used, the log sines, cosines, &c., can, in most cases, be taken at sight to the nearest 30″; this is not, however, the case with the proportional logs; where they occur the strictest accuracy must be observed, and the decimals of seconds must not be neglected. This remark also applies to the Moon's Declination, Right Ascension, Horizontal Parallax, and Semidiameter.

This observation is much easier, and more certain in its results, than the lunar observation. As the instrument (the telescope) is one that every person can use, and is not liable to any error, all that is required is that the observer shall be certain that one instant he does see the star and that the next instant he does not (with an emersion the exact contrary is the case). Neither is there much difficulty in recognising the star, as the moon only moves its own diameter among the stars in an hour, and there is ample time after the star and moon are in, apparent, close proximity to make sure of the star. Before, or immediately after this observation, a set of sights should be taken to find the error of the watch on apparent or mean time at place.

## *Rough Determination of the Parallaxes in Declination and Right Ascension of a Heavenly Body, and its Application to the Prediction of Occultations.**

*By* Major S. C. N. Grant, R.E.

The diagram facing p. 174 is designed for the purpose of obtaining rapidly, and with some degree of accuracy, the parallaxes in declination and right ascension of the moon, and the practical use to which the parallaxes, so obtained, are put is that of predicting the elements of occultations of stars by the moon preliminary to making observations for the determination of longitude.

The generally accepted systems, both theoretical and graphic, of calculating the local elements of occultations are somewhat long and tedious; whereas the system to be described in these notes is rapid, simple, and sufficiently accurate for practical purposes.

The diagram itself represents an orthographic projection of the Earth, showing parallels of latitude and hour circles; the line OO represents the projection of the equator, and the projections of the parallels of latitude are drawn at intervals of 5°. The divisions on the circumference of the circle, however, give the positions of parallels to each degree, and as the intervals between these divisions can be divided into four parts, latitude can be plotted to 15′.

The hour circles are drawn only on the eastern half of the circle, and a portion of the north-west quadrant. They are numbered in two ways—one from O at the centre to VI. at the east circumference; and the other from O at that circumference to VI. at the centre, and continued to VII. and VIII. beyond the centre. The use of these two systems of numbering will be explained hereafter. Where the space permits, the intervals between the hour circles have been subdivided into spaces representing five minutes; the hour nearest the circumference is divided only into spaces of fifteen minutes. Near the centre of the circle these divisions can be subdivided by eye into five parts, each part representing one

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* Separate copies of this paper with the diagrams mounted can be purchased at the Society's rooms.

minute, which may be taken as the limit of accuracy to which the hour angle can be plotted, and consequently need be calculated. The accuracy, however, decreases as the divisions become smaller near the circumference and in high latitudes.

In the south-west quadrant, the radius of the circle and the radii of all the declination circles up to 32°, the limit of the moon's declination, are divided into scales of one hundred parts.

### *Parallax in Declination.*

Plot on the diagram the position of the place of observation from its known latitude and the hour angle, counting the hour angles from *right to left*—that is, from the circumference towards the centre. Call this point A. Draw a straight line through the centre of the circle and that division of the circumference representing the moon's declination, above or below the line OO according as the declination is north or south, and in the same side of the circle as that from which the hour angles commence to count. Denote this line by CB.

The length of the perpendicular drawn from the point A to the straight line CB, produced if necessary, is a measure of the parallax in declination. With a pair of compasses, find what proportion the length of this line bears to the radius of the circle, which is divided into a hundred parts on the diagram; multiply this proportion by the horizontal parallax of the moon, and the product is the parallax in declination.

Let us take an example—

Latitude, 10° 30′ N.; moon's declination, 20° 50′ 30″ N.; moon's horizontal parallax, 59′ 16″; hour angle, 1h. 40m.

On the diagram the point A is plotted at lat. 10° 30′ N., and hour angle 1h. 40m., counting the hour angles from the circumference towards the centre as numbered in the lower line of figures. CB is drawn through the centre C and the division on the circumference representing the declination 21° N. approximately.

If the diagram represents an orthographic projection of the Earth on a vertical plane passing through the centres of the Earth and moon, the point A and the line CB are the projections of the place of the observer and of a line joining the centres of those two bodies.

AD, being the perpendicular dropped from A on to BC, is a measure

of the parallax. The length of AD is found on actual measurement to equal $\frac{15}{100}$ of the radius FC of the circle; so that—

$$\begin{aligned}\text{Parallax} &= \tfrac{15}{100} \times \text{horizontal parallax} \\ &= \tfrac{3}{20} \times 59' \, 16'' \\ &= 8' \, 48''\end{aligned}$$

Were the declination south instead of north, the parallax would be represented by AD′; this equals $\frac{49}{100}$ of the radius, and the parallax would equal—

$$\tfrac{49}{100} \times 59' \, 16'' = 29' \, 0''$$

In some cases the hour angle may exceed six hours, and the line of the moon's declination may require to be produced through C; for instance, the line EF represents the parallax in declination under the conditions—latitude, 45° N.; hour angle, 6h. 45m.; declination, 30° S.

*Sign of the Parallax in Declination.*—If the place of observation as plotted in the diagram is below the line drawn through the centre and the declination, the effect of the parallax will obviously be to move apparently the position of the moon towards the north; it will thus increase north and decrease south declination. The converse is also true. Thus, in the first example the parallax represented by AD would be added to the moon's north declination; that by AD′ would be added to the moon's south declination; and that by EF would be added to the moon's south declination.

*Parallax in Right Ascension.*

The diagram now represents a similar projection on a vertical plane at right angles to the former, and the hour angles should be plotted from the vertical line passing through the centre of the circle, and counted as numbered in the upper series of figures. If from the point plotted by latitude and hour angle a perpendicular line be drawn to the centre vertical line, the length of this perpendicular is a measure of the parallax; but instead of being, in all cases, measured on the radius of F C of the circle, as in finding the parallax in declination, it should be measured on the scale of the radius of that declination circle representing the moon's declination. These radii for declinations from 0° to 32°, which covers the

range of the moon's declination, are divided each into one hundred parts in the south-west quadrant of the figure. The proportion of the perpendicular to the radius of the particular declination circle, multiplied by the moon's horizontal parallax, is the parallax in right ascension.

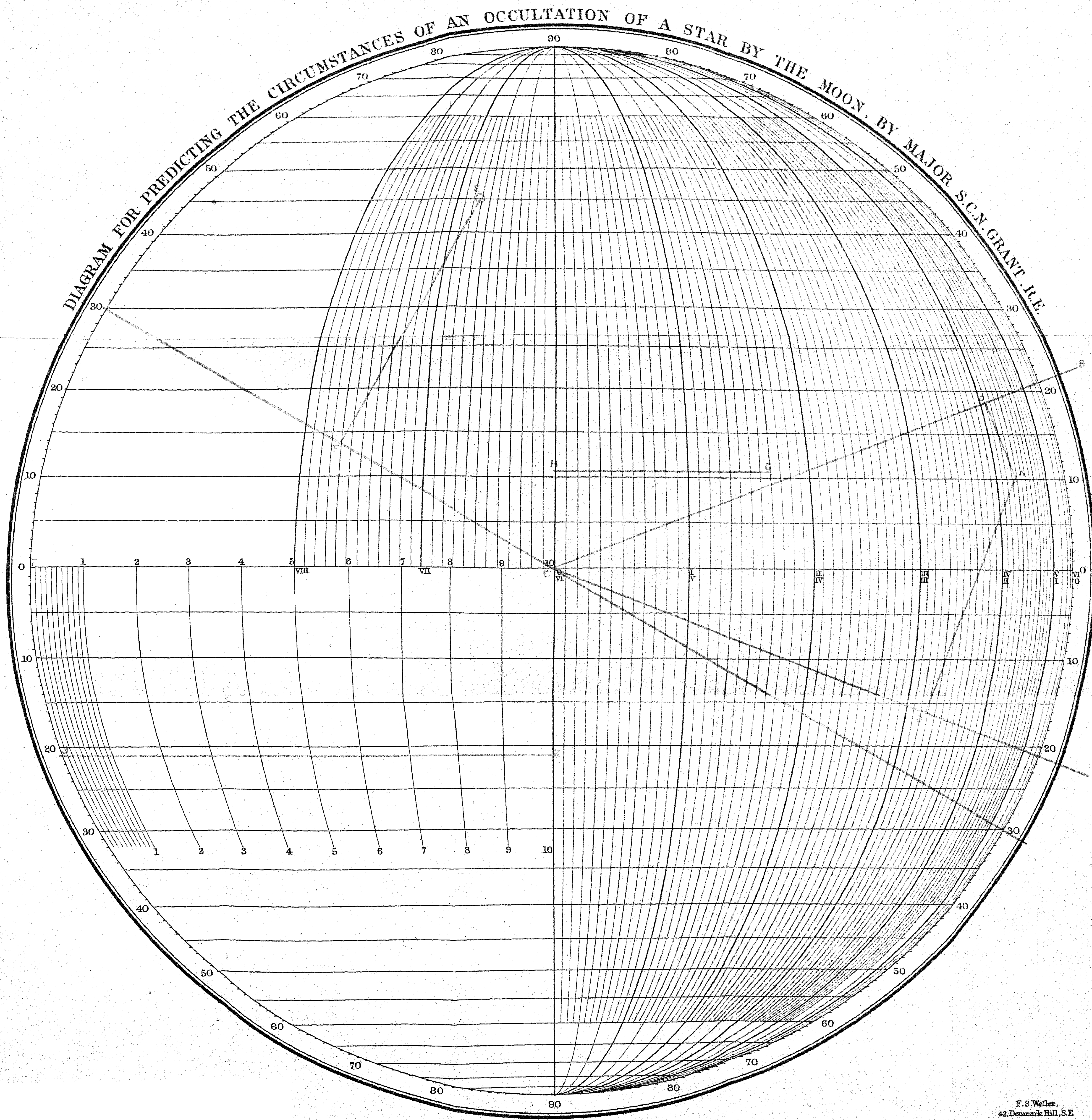
Both parallaxes will be in terms of arc or time, according as the horizontal parallax is stated in arc or time.

Let us take, as an example, the same values as those in the first example of parallax in declination. The point G represents the place of the observer plotted at latitude 10° 30′; whether north or south is immaterial, and 1h. 40m., the hour angles being counted, as before explained, from the centre outwards. GH, the perpendicular let fall from G on to the centre meridian, is a measure of the parallax. The moon's declination is practically 21°, and so GH is measured on the scale JK, and equals forty-five parts, so that—

$$\begin{aligned} \text{Parallax} &= \tfrac{45}{100} \times \text{horizontal parallax} \\ &= \tfrac{9}{20} \times 59'\,16'' \\ &= 26'\,36'' \text{ (arc)} \\ &= 1\text{m. } 46\text{s. (time)} \end{aligned}$$

*Sign of the Parallax in Right Ascension.*—If the sidereal time at place exceeds the moon's right ascension, that is, if the moon is to the west of the meridian, the effect of parallax is to decrease the moon's right ascension. The converse is also true.

The most convenient way of using the diagram is to cover it with a piece of tracing-paper, and to draw a line on the tracing-paper across the diagram at the latitude of observer's station. Place a ruler to represent the line joining the centres of the Earth and moon. Then with one leg of a pair of compasses on the point at which the hour circle cuts the latitude line, adjust the other leg so that, when swept round, it touches the edge of the ruler in one case, or the central meridian in the other; the compasses are then open to the length of the perpendicular, and the proportion to the particular radius can can be scaled off at once. These proportions can be conveniently multiplied by the horizontal parallax by means of a slide rule.

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*Predictions of Occultations.*

The 'Nautical Almanac' gives the elements of occultations as they would be seen from the centre of the Earth, and although the limits of latitudes between which the star may be occulted are stated, this does not mean that the star will be occulted as seen from every place within the limits stated, but rather that outside these limits the star cannot be occulted. Again, although an occultation may be visible, the star's apparent path may so approach a tangent to the moon's disc as to render the results obtained from the observation of such an occultation unreliable. The time of occultation may, owing to the effects of parallax, be any time from about two hours before to the same interval after the time of conjunction as given in the 'Nautical Almanac.' These circumstances render it desirable to determine, before attempting to observe an occultation, whether the star as seen from the observer's station will be occulted at all, and if so, at what time approximately it may be looked for, and at what portion of the moon's disc the star will disappear and reappear. The simplest way of doing this is to draw to scale the position of the star, and relatively to it the path of the moon as affected by parallax.

*Example.*

Immersion and Emersion of ω *Leonis*, February 3rd, 1901, Lat. 30° 58′ N., approximate Long. 5° W.; ☽ W. of Meridian. G.M.T. of Conjunction 14h. 27m. 40s. (taken from 'Nautical Almanac.')

At 14 hrs.
Var. in ☽'s R.A. in 10′.

| | s |
|---|---|
| | 20·3 |
| | 6 |
| 60) | 121·8 |
| | 2 1·8 |

☽'s Hor. Par. Midnight, Feb. 3rd.

′ 55·83

☽'s semidiameter Midnight, Feb. 3rd.

′ ″ 15 14·3

| | H. M. S. |
|---|---|
| Sidereal time at G. M. noon, Feb. 3rd | 20 51 52·4 |
| 14h. accelerated for 14h. | +14 2 18 |
| Sidereal time at Greenwich | =10 54 10·4 |
| West Long. in time | − 0 20 00 |
| Sidereal time at Place | 10 34 10·4 |
| ☽'s R.A. at 14h. | 9 22 15·8 |
| ☽'s hour angle at 14h. G.M.T. | 1 11 54·6 |
| | + 1 00 00 |
| | 2 11 54·6 |
| ☽'s change in R.A. for 1 hour − because ☽ west of Meridian | − 2 1·8 |
| ☽'s hour angle at 15h. G.M.T. | 2 9 52·8 |
| | + 1 00 00 |
| | 3 9 52·8 |
| ☽'s change in R.A. for 1 hour − because ☽ west of Meridian | − 2 1·8 |
| ☽'s hour angle at 16 h. G.M.T. | = 3 7 51·0 |

| | ° ′ ″ |
|---|---|
| ☽'s declination at 14h. | 10 12 2·3 N. |
| Parallax in declination − | 0 20 15·9 |
| Prepared declination | 9 51 46·4 N. |

| | ° ′ ″ |
|---|---|
| ☽'s declination at 15h. | 10 1 51·1 N. |
| Parallax in declination − | 0 21 26·2 |
| Prepared declination | 9 40 24·9 N. |

| | ° ′ ″ |
|---|---|
| ☽'s declination at 16h. | 9 51 37·7 N. |
| Parallax in declination − | 0 23 13·5 |
| Prepared declination | 9 28 24·2 N. |

$\frac{36\cdot3'}{100} \times 55\cdot83$

| |
|---|
| ·363 |
| 55·83 |
| 1089 |
| 2904 |
| 1815 |
| 1815 |
| 20·26629 = 20 15·9″ |

| | ° ′ ″ |
|---|---|
| ☽'s R.A. at 14h. .. .. | 140 33 57 |
| Parallax in R.A. .. .. | − 0 15 4·4 |
| Prepared R.A. | 140 18 52·6 |

$\frac{38\cdot4'}{100} \times 55\cdot83$

| |
|---|
| ·384 |
| 55·83 |
| 1152 |
| 3072 |
| 1920 |
| 1920 |
| 21·43872 = 21′ 26·2″ |

| | ° ′ ″ |
|---|---|
| ☽'s R.A. at 15h. .. .. | 141 4 22·5 |
| Parallax in R.A. .. .. | − 0 26 7·6 |
| Prepared R.A. | 140 38 14·9 |

$\frac{41\cdot6'}{100} \times 55\cdot83$

| |
|---|
| ·416 |
| 55·83 |
| 1248 |
| 3328 |
| 2080 |
| 2080 |
| 23·22528 = 23′ 13·5″ |

| | ° ′ ″ |
|---|---|
| ☽'s R.A. at 16h. .. .. | 141 34 43·5 |
| Parallax in R.A. .. .. | − 0 35 43·8 |
| Prepared R.A. | 140 58 59·7 |

$\frac{27'}{100} \times 55\cdot83$

| |
|---|
| ·27 |
| 55·83 |
| 81 |
| 216 |
| 135 |
| 135 |
| 15·0741 = 15′ 4·4″ |

$\frac{46\cdot8'}{100} \times 55\cdot83$

| |
|---|
| ·468 |
| 55·83 |
| 1404 |
| 3744 |
| 2340 |
| 2340 |
| 26·12844 = 26′ 7·6″ |

$\frac{64'}{100} \times 55\cdot83$

| |
|---|
| ·64 |
| 55·83 |
| 192 |
| 512 |
| 320 |
| 320 |
| 35·7312 = 35′ 43·8″ |

| | H. | ° ′ ″ |
|---|---|---|
| Prep. decl. at | 14 | 9 51 46·4 N. |
| ,, ,, | 15 | 9 40 25·0 N. |
| Diff. | | 11 21·4 |

| | H. | ° ′ ″ |
|---|---|---|
| Prep. decl. at | 14 | 9 51 46·4 N. |
| ,, ,, | 16 | 9 28 24·2 N. |
| Diff. | | 23 22·2 |

| | H. | ° ′ ″ |
|---|---|---|
| Prep. R.A. at | 14 | 140 18 52·6 |
| ,, ,, | 15 | 140 38 14·9 |
| Diff. | | 19 22·3 |

| | H. | ° ′ ″ |
|---|---|---|
| Prep. R.A. at | 14 | 140 18 52·6 |
| ,, ,, | 16 | 140 58 59·7 |
| Diff. | | 40 7·1 |

| | ° ′ ″ |
|---|---|
| ☽'s prepared declination at 14h. | 9 51 46·4 N. |
| Declination of ω Leonis .. .. | 9 29 0·7 N. |
| Diff. | 22 45·7 |

| | ° ′ ″ |
|---|---|
| ☽'s prepared R.A. at 14h. | 140 18 52·6 |
| R.A. of ω Leonis.. .. .. | 140 47 58·5 |
| Diff. | 29 5·9 |

In the above example the G.M.T. of geocentric conjunction is 14h. 27m. 40secs., and the calculation is commenced with the view of finding the parallaxes at 14h., 15h., 16h., so as to plot the position of the moon at those three times, and from those positions as plotted, to draw the path of the moon's centre. Before we can plot the parallaxes off the diagram, the hour angles must be determined, and the first portion of the calculation is for this purpose. The hour angle at 14h. is found to be 1h. 11m. 54·6 secs., and since the sign is + the moon is on the west of the meridian. This, according to the rule before stated for the sign of the parallax in right ascension, throws back the moon in right ascension, and as far as the effect of that only is concerned, delays the time of conjunction; so that we may infer that this time, instead of being between 14h. and 15h., may be between 15h. and 16h., and it will consequently be better to plot the position of the moon at three hours, and the hour angles for those times are noted down. It is not necessary to recalculate the hour angles, but for each difference of one hour of G.M.T. add *algebraically* about 58m. to the hour angle. That is to say, when the moon is on the west of the meridian the hour angle may be considered positive and is increasing, and when the moon is on the east of the meridian the hour angle may be considered negative and is decreasing.

The moon's horizontal parallax and semi-diameter are next taken from the N.A.; they should be corrected approximately to time of occultation.

The remainder of the calculation consists simply in applying the parallaxes, scaled from the diagram, to the right ascensions and declinations of the moon taken from the N.A., and in taking the differences of the right ascensions and declinations as well as those of one of the positions of the moon and of the star. These differences are taken out only to facilitate plotting the relative positions on a figure or drawing. See that the right ascensions and their parallaxes are stated both either in time or in arc.

### *Construction of the Figure.*

The point A (see diagram facing p. 180) is taken as the position of the moon's centre at 14h. G.M.T., and relatively to this B represents

the same at 15h., C at 16h., and S that of the star. B, C and S are plotted from their differences of right ascension and declination from A. A circle described with S as centre and radius equal to the moon's semi-diameter, cuts the moon's path at D and E; these two points are positions of the moon's centre at the times of disappearance and re-appearance respectively. Should this circle fail to cut the line of the moon's path, it shows that no occultation will take place. The moon passes over the distance A B in one hour, and if we assume its motion uniform, we have the time the moon takes to travel over $AD = \frac{AD}{AB} \times 60$ m.

The lengths of A D and A B may be measured on any convenient scale. In the present instance the point D happens to coincide with B, and A D therefore equals A B, and the G. M. T. of disappearance is 15 hrs., or, correcting for longitude, the local time is 14 hrs. 40 m. 0 s.

Similarly, by scaling off B C and C E, their lengths are found to bear the proportion of 24 and 4·6, so that the time the moon's centre would take to traverse the distance

$$C\,E = \frac{4 \cdot 6}{24} \times 60 \text{ min.}$$
$$= 11 \text{ mins. } 30 \text{ secs.}$$

and the G. M. T. of reappearance is 16 hrs. 11 m. 30 s., and, applying as before the correction for longitude, the local time is 15 hrs. 51 m. 30 s.

*Angles of Disappearance and Reappearance.*

*From the North point of the Moon's limb*:—Any lines drawn, on the figure, parallel to the direction in which have been plotted the differences in declination will represent portions of celestial meridians, and such a line, if drawn through the centre of the moon, will cut its circumference at its north and south points. The line P D Q, drawn through the centre of the moon D, cuts the circumference at P and Q, which are respectively the north and south points, because, in constructing the figure, it was assumed that north declination increased from the bottom towards the top. The moon's motion is also plotted in the direction from A towards E, and since its motion in the heavens is from west to east, R represents the eastern side of the moon's disc. The angle of dis-

appearance, measured from the north point of the limb towards the east, is therefore P D S = 139°.

Similarly the angle of reappearance is 360° – P′ E S = 280°.

*From the Vertex of the Moon's limb** :—Since the parallax of a heavenly body lies in the plane passing through that body, the earth's centre and the vertex of the observer, it follows that if, on the figure, are plotted the positions of any point of the body as affected by parallax, and as unaffected by the same, the line joining these two positions, and all lines parallel to it, represent portions of celestial great circles passing through the vertex of the observer, and one of the points at which such a line passing through the centre of the moon cuts its limbs will be a vertex of the moon, according as the observer is north or south of the same. In the figure, C is the position of the moon's centre at 16 hrs. plotted as affected by parallax, and F is its real position, that is unaffected by parallax. H D is drawn parallel to F C, then H is the vertex of the moon's limb, and the angle of disappearance measured towards the east is H D S = 89°. Similarly the angle of disappearance is 360° – K E S = 223°.

The most convenient way of drawing the figures is on what is known as logarithm paper, ruled with blue or red lines into squares. If these lines are drawn about a quarter of an inch apart, and each division is taken to represent one minute of arc, a figure can conveniently be drawn on half a sheet foolscap size.

After a very little practice, the calculations of hour angles, scaling off the parallaxes, and drawing the diagram can all be done in from a quarter of an hour to twenty minutes, and if done with only a moderate amount of care, the error of the time either of disappearance or reappearance arrived at should not exceed ten minutes. The mean error of a large number worked out was 4·5m. The angles, however, should differ only a degree or two from the correct angles of disappearance or reappearance respectively.

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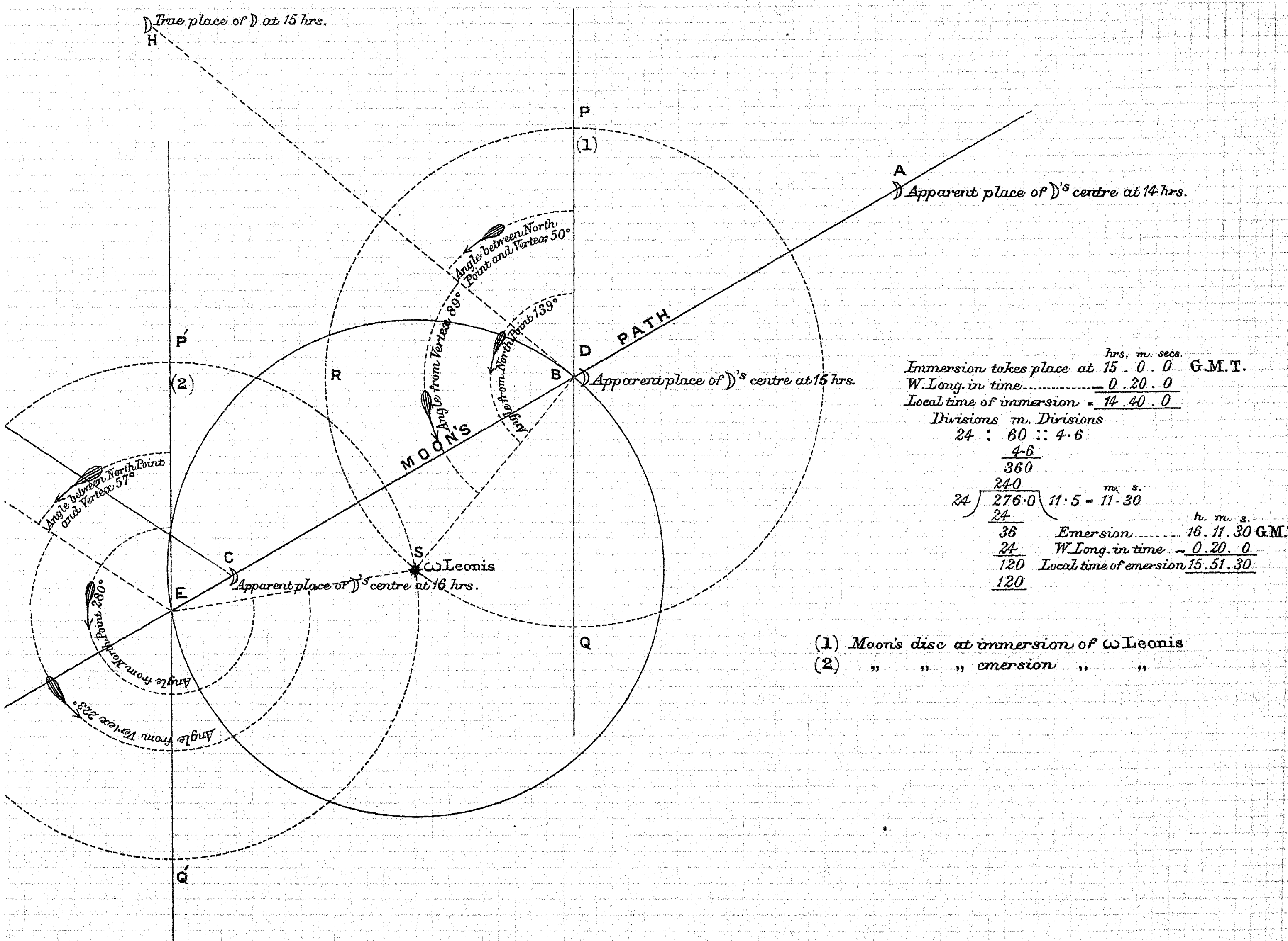
* The substance of this paragraph is taken from a paper by E. A. Reeves, F.R.A.S., printed in the *Geographical Journal* for Feb., 1898.


True place of ☽ at 15 hrs.
H
P
(1)
A
☽ Apparent place of ☽'s centre at 14 hrs.
Angle between North Point and Vertex 50°
Angle from Vertex 89°
Angle from North Point 139°
MOON'S PATH
D
B
☽ Apparent place of ☽'s centre at 15 hrs.
R
P′
(2)
Angle between North Point and Vertex 57°
C
☽ Apparent place of ☽'s centre at 16 hrs.
S
ω Leonis
E
Angle from North Point 280°
Angle from Vertex 223°
Q
Q′
hrs. m. secs.
Immersion takes place at 15 . 0 . 0 G.M.T.
W. Long. in time — 0 . 20 . 0
Local time of immersion = 14 . 40 . 0
Divisions m. Divisions
24 : 60 :: 4·6
4·6
360
240
24 ) 276·0 ( 11·5 = 11 - 30
24
36
24
120
120
m. s.
h. m. s.
Emersion 16 . 11 . 30 G.M.T
W. Long. in time — 0 . 20 . 0
Local time of emersion 15 . 51 . 30
(1) Moon's disc at immersion of ω Leonis
(2) „ „ „ emersion „ „

*Longitude by the Occultation of a Star.*

October 21st, 1898.—Immersion of B. A. C. 6607. Time by watch was 1 h. 15 m. 12 sec., and watch 5 h. 0 m. 0·2 sec. slow of local time. Lat. 38° 24′ N. Approx. Long. 77° 18′ 45″ E. ☽ West of Meridian.

| | | H. | M. | S. |
|---|---|---|---|---|
| Time by Watch of Immersion | | 1 | 15 | 12 |
| Error of Watch on Local Time | + | 5 | 0 | 0·2 |
| Mean Time at Place | = | 6 | 15 | 12·2 |
| East Long. in Time .. | − | 5 | 9 | 15 |
| Corresponding G. D., Oct. 21st | | 1 | 5 | 57·2 |

| | | ′ | ″ |
|---|---|---|---|
| ☽'s Semid. Noon | .. | 16 | 11·60 |
| ,, ,, Midt. | .. | 16 | 10·26 |
| 12 hourly diff. | = | | 1·34 |

1·34 × 1·1 ÷ 12 = 0·12

| | | ′ | ″ |
|---|---|---|---|
| Corr. for G. D. .. .. | | 0 | 0·12 |
| Semid. Noon .. .. | | 16 | 11·60 |
| ☽'s Semid. for G.D. | = | 16 | 11·48 |

| | | ° | ′ | ″ |
|---|---|---|---|---|
| Latitude .. .. | | 38 | 24 | 0 N. |
| Reduction (XXXV.) | − | | 11 | 10 |
| Geocentric Lat. .. | | 38 | 12 | 50 |

| | | ′ | ″ |
|---|---|---|---|
| ☽'s Hor. Par. Noon .. .. .. | | 59 | 19·71 |
| ☽'s Hor. Par. Midt. .. .. .. | | 59 | 14·81 |
| 12 hourly diff. .. .. | = | | 4·9 |

4·9 × 1·1 ÷ 12 = ·45

| | | ′ | ″ |
|---|---|---|---|
| Corr. for 12 Hourly Diff. for G.D. | = | −0 | 0·45 |
| ☽'s Hor. Par. Noon .. .. .. | | 59 | 19·71 |
| ☽'s Hor. Par. corr. for G. D. .. | | 59 | 19·26 |
| Correction for Lat. (XXXIV.) .. | | − | 4·4 |
| ☽'s Reduced Hor. Par. .. .. | = | 59 | 14·86 |

| Month. Day. | | H. | M. | S. |
|---|---|---|---|---|
| Sidereal Time (p. ii. N. A.).. .. .. .. .. .. | | 13 | 59 | 48·71 |
| Accel. (XXXI.) 1 H. .. .. .. .. .. | = | | | 9·86 |
| 5 M. .. .. .. .. .. | = | | | ·82 |
| 57 S. .. .. .. .. .. | = | | | ·16 |
| Reduced Sidl. Time .. .. .. .. .. .. .. | | 13 | 59 | 59·55 |
| Mean Time at Place .. .. .. .. .. .. | + | 6 | 15 | 12·20 |
| R. A. of Meridian .. .. .. .. .. .. .. | = | 20 | 15 | 11·75 |
| ✳'s Right Ascension .. .. .. .. .. .. | − | 19 | 14 | 35·09 |
| ✳'s Hour Angle .. .. .. .. .. .. .. | = | 1 | 00 | 36·66 |
| | | ° | ′ | ″ |
| ✳'s Declination .. .. .. .. .. .. .. .. | | 22 | 35 | 29·1 S. |

| | | ° | ′ | ″ |
|---|---|---|---|---|
| ☽'s Declination Oct. 21st at 1 hour .. .. .. | | 21 | 51 | 39·6 S. |
| * Variation of Decln. in 1 m. 7·56″ × 5·95 min. of G. D. .. .. .. .. .. .. .. | = | | | 44·97 |
| Reduced Declination .. .. | = | 21 | 50 | 54·63 S. |

* The variation in 1 m. is found by removing the decimal point in the difference of Declination in 10 minutes (given in the 'Nautical Almanac'), one figure to the left hand.

| | |
|---|---|
| ☽'s Reduced Hor. Par. pro Log. .. | 0·4826 |
| Geocentric Latitude. Cosec. .. .. | 0·2086 |
| ✳'s Declination. Secant. .. .. | 0·0347 |
| Arc A = 33′ 50″ = Pro Log. = | 0·7259 |

Arc A = 33 50
Arc C − 00 00
(A−C) = 33 50

| | |
|---|---|
| .. .. .. .. .. .. .. .. | 0·4826 |
| .. .. .. .. .. .. Sec. .. | 0·1047 |
| .. .. .. .. .. .. Cosec. | 0·4155 |
| ✳'s Hour ∠ Sec. | 0·0154 |
| Arc B = 17′ 15″·75 = Pro Log. = | 1·0182 |

| | | |
|---|---|---|
| .. .. .. .. .. .. .. .. | | 0·4826 |
| .. .. .. Sec. .. .. .. | | 0·1047 |
| ✳'s Hour ∠ Cosecant.. .. .. | | 0·5826 |
| ‖ Sum of 3 Logs. .. .. .. | = | 1·1699 |
| | × | 2 |
| | | 2·3398 |
| Constant.. .. .. .. .. .. | + | 1·5820 |
| ✳'s Declination Cotan. .. | + | 0·3808 |
| Arc C = 00′ 00″ = Pro Log. | = | 4·3026 |

(Continued on p. 182.)

| | ° | ′ | ″ |
|---|---|---|---|
| ✳'s Declination .. .. .. .. .. | 22 | 35 | 29·1 |
| (A – C) – when Lat. and Decl. different name; + ,, ,, ,, same name .. .. | – | 33 | 50·0 |
| | 22 | 1 | 39·1 |
| B – when Hour ∠ is *less* than 6 hours + when more .. .. .. | – | 17 | 15·75 |
| Prepared Declination .. .. .. .. .. = | 21 | 44 | 23·35 |

*Part I. for ☽'s Parallax in R. A.*

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| Prepared Declination .. | 21 | 44 | 23·35 | Cosine .. .. | 9·9680 |
| ☽'s Declination .. .. | 21 | 50 | 54·63 | Constant .. | 1·1761 |
| Difference .. .. .. | | 6 | 31·28 | | |
| ☽'s Semidiameter .. | | 16 | 11·48 | | |
| Difference .. | 0 | 9 | 40·20 | ½ Pro Log. .. | 0·6349 |
| Sum .. .. | 0 | 22 | 42·76 | ½ Pro Log. .. | 0·4495 |
| | m. | sec. | | | |
| Part I. = | 1 | 3·82 = Pro Log. = | | .. .. | 2·2285 |

*Part II.*

| | |
|---|---|
| .. .. .. .. .. .. Cosine .. .. | 9·9680 |
| .. .. .. .. .. .. Constant.. .. | 1·1761 |
| ‖ Sum of 3 Logs. used to find C... .. .. .. | 1·1699 |
| Part II. 0 m. 52·41 s. = Pro Log. .. .. .. .. | 2·3140 |

| | H. | M. | S. |
|---|---|---|---|
| ✳'s R. A. | 19 | 14 | 35·09 |
| Part I. {If Immersion –; If Emersion +} .. .. .. .. | – | 1 | 3·82 |
| | 19 | 13 | 31·27 |
| Part II. {When ☽ W. of Merid. +; When ☽ E. of Merid. –} .. .. .. | + | | 52·41 |
| ☽'s Right Ascension .. .. .. .. .. = | 19 | 14 | 23·68 |

Hour for which (2) was taken from N.A. = 1 h. .. ..

| | H. | M. | S. | | |
|---|---|---|---|---|---|
| (1) ☽'s R. A. (thus found) .. .. .. | 19 | 14 | 23·68 | | |
| (2) ☽'s R. A. preceding hour .. .. | 19 | 14 | 08·45 | | |
| (3) ☽'s R. A. following hour .. .. | 19 | 16 | 37·70 | Constant .. .. .. .. | 0·4771 |
| Diff. between (1) and (2) .. .. .. | | 0 | 15·23 | Pro Log. .. .. .. .. | 2·8509 |
| Diff. between (2) and (3) .. .. .. | | 2 | 29·25 | Ar. Co. Pro Log. .. .. | 8·1405 |
| | 0 | 6 | 7·14 | = Pro Log. .. .. .. = | 1·4685 |
| *Hour* of (2) .. .. .. .. .. .. .. + | 1 | 0 | 0 | | |
| ** G. M. T. .. .. .. .. .. .. | 1 | 6 | 7·14 | | |
| Mean Time at Place .. .. .. .. .. | 6 | 15 | 12·20 | | |
| Longitude in Time .. .. .. .. .. | 5 | 9 | 5·06 | = 77° 16′ 15″·9 E. | |

** For extreme accuracy, re-compute Part I. with this G.M.T., and the result will be the true G.M.T., possibly some seconds different from the first obtained.

*Longitude by Lunar Distance.*

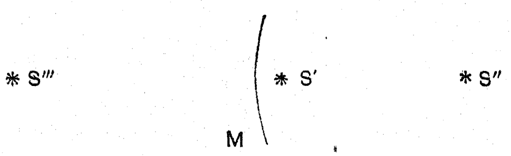
In this observation the observed distance is not only liable to errors caused by a defect of parallelism in the telescope, which always makes the observed distance too great, but to all other instrumental errors, some of which may very possibly be unknown to the observer, and as an error in the distance, of whatever kind, produces about thirty times its amount in longitude, it will be readily understood that but little value can be attached to the results obtained from a single set of lunar distances, even when the observation has been taken by a competent person, as making the contact slightly above or below the centre of the field, combined with the effects of irradiation, may very well cause an error of 20″ in the observed distance, the effect of which would be, in average cases, 600″ or 10′ error of longitude. For these reasons lunar observations cannot be recommended to any person who has not acquired a perfect knowledge of the use of the sextant, its errors and adjustments; or who is unable to remain at one place long enough to take a series of distances east and west of the moon.

*To Measure the Angular Distance between the Moon and Sun.*—As the enlightened limb of the moon is always nearest to the sun, the angular distance measured is always that of the near limbs; but since, on account of her comparatively feeble light, it is necessary to observe the moon by direct vision, and since the sun at the time of observation may be either to the east or the west of the moon, the sextant has to be held with its face up or down as the case may require. In *north latitude*, when the sun is to the west of the moon, the instrument is held with its face upwards; but when the sun is to the east of the moon, it must be held with its face downwards. In *south latitude* the *opposite* of this rule must be followed. This is often much easier if the observer can hold the sextant in his left hand; the position of the hand and wrist may otherwise be cramped and almost painful. Before taking an observation, look at the sun through the dark shades, and select those which reduce its brightness in the greatest degree compatible with good definition; put these down before the index glass; see that the inverting telescope is adjusted to focus; set the index to zero (0°); and hold the instrument with its plane parallel to a line joining the sun and moon; look at the moon through the telescope collar and horizon glass, and move the index

slowly forward until the sun's reflected image makes a rough contact with the moon, seen by direct vision through the unsilvered part of the horizon glass; clamp the index, screw in the telescope, and make the contact perfect in the centre of the field with the tangent screw, moving the sextant slowly round the axis of the telescope, by which means the reflected image of the sun will appear to pass the moon, and the accuracy of the contact can be tested.

*Between the Moon and Star or Planet.*—The angular distance between a star or planet and the moon is always measured to the moon's enlightened limb, which is often the farthest from the star or planet. When this is the case, the moon must be brought by reflection past the star or planet before the contact can be made: in other respects the observation is precisely similar to that already described, when the angular distance of the sun is taken.

In observations of this class, the utmost attention must be paid to accuracy, and a faulty habit of observation in making contacts of the moon's limb with a star is not necessarily eliminated, as is very generally supposed, and frequently stated, by taking distances east and west of the




moon. For example, if it is an observer's habit, in making a contact, to place the star within the moon's disc, M, as at S′, the distance S″ S′ is too small, and the distance S‴ S′ too great; but supposing the moon to be moving in the direction from S′ to S‴, each distance will give too early a Greenwich time, for each will give the time when the moon's limb was actually at S′. When, however, the sun is the object observed east and west of the moon, errors of this sort in observation, *if constant*, will be eliminated, since, as the moon's enlightened limb is always turned towards the sun, such errors would increase both distances and produce errors of an opposite description in the Greenwich time.* A single observation is of little value;

* For further information on this subject, read the article on Lunar Distances in '*Chauvenet's Spherical Astronomy.*'

distances should always be observed in sets, with stars east and west of the moon, and as nearly equidistant from it as possible; the observer should also note which limb of the moon has been observed, and whether the star was east or west of it. The more nearly the two bodies approach the same horizontal plane, the easier will be the observation to take, and distances between 45° and 90° will be least liable to errors in observation.

The thermometer and the barometer (or its equivalent, a boiling-point thermometer) should be noted, and the refraction corrected accordingly; because, if thermometric and barometric corrections be omitted, in observations made on a high and heated plateau, there may be serious errors in the results.

A complete pair of lunars, made wholly by one person, consists of the following observations, *in addition to those for latitude.*

An hour before beginning to observe, get everything in perfect order; see that the lamp is well trimmed, its air-holes free, and that it is filled with oil. Also rehearse the expected observations, that no hitch may occur after they have commenced. Then let the hand and eye have ample time to repose, and go on as follows:—

1. Read thermometer and barometer.
2. Observations for index error.
3. Three altitudes for time, star E.
4. Three altitudes for time, star W.
*5. Three altitudes of moon.
6. Five lunar distances, star E. of moon.
7. Five lunar distances, star W. of moon.
*8. Three altitudes of moon.
*9. Three altitudes for time, star W.
*10. Three altitudes for time, star E.

It is not absolutely necessary to take the altitudes marked with an asterisk, as they can be computed as shown on p. 193. For this purpose, however, it is necessary that the latitude of the place, and the exact local time when the distances were observed, should be known. The time can be found in the manner shown on pp. 153-157. The observation for time, the latitude of the place, and which limb of the moon was

observed, should be carefully entered in the note-book for the convenience of the computer.

*Clearing the Lunar Distance by Raper's Rigorous Method.*—As this is one of the shortest, and at the same time a strictly accurate method of clearing the Lunar Distance, it is here given for the benefit of those travellers who may not have Raper's work in their possession.

Having found the Greenwich date with the assumed longitude in time, and the mean time at place by a watch, the error of which on local time has been found by previous observation, reduce thereto the moon's horizontal parallax and semidiameter, and if the sun be one of the objects observed, take its semidiameter from the 'Nautical Almanac.' From the observed altitudes get the apparent and true altitudes; from the observed distance get the apparent distance. Add to, or subtract from the apparent altitudes as many seconds as are necessary to bring them to odd or even minutes, then add them together and subtract their sum from 180°, and the remainder will be the sum of the Apparent Zenith Distances.

Increase or diminish the True Altitudes by the same number of seconds as were added to or subtracted from their respective Apparent Altitudes; add them together and subtract their sum from 180°, and the remainder will be the sum of the True Zenith Distances.

Add together the Log-secants of the Apparent Altitudes and the Log-cosines of the True Altitudes; the sum, rejecting tens in the index, will be the Logarithmic Difference.

Increase or diminish the Apparent Distance by any quantity of seconds necessary to bring it to an odd or even minute (noting the number of seconds); to this add the sum of the Apparent Zenith Distances; take Half the sum, and from this Half Sum subtract the Apparent Distance—call this Remainder.

To the Log-sines of the Half Sum and Remainder add the Logarithmic Difference, and the sum, rejecting tens in the index, will be the Log-sine square of the auxiliary arc $x$.

Arc $x$ may also be found without any special table of log sines square in the following manner:—When the sum of these three logs has for an index a number above 20, reject 10 from such index, and then divide the sum by 2; this will give ½ the log-sine of the arc, which multiplied by 2 will give auxiliary arc $x$; *this,*

*of course, applies to all cases where a log-sine square is mentioned* (*see* note p. 154).

Under $x$ put the sum of the True Zenith Distances, take their sum and difference and their Half Sum and Half Difference, add together the log-sines of the Half Sum and Half Difference, and their sum is the log-sine square of an arc, to which apply the same number of seconds by which the Apparent Distance was increased or diminished to bring it to an odd or even minute, subtracting them if the Apparent Distance was increased, but adding them if diminished, and the result will be the true distance nearly. Take the difference between the proportional logs in the 'Nautical Almanac' against the two distances between which the computed true distance falls. With this difference and the portion of time just found, enter the table of corrections for second differences ('Nautical Almanac' or table 57 Raper), and take out the seconds. When the proportional logs in the 'Nautical Almanac' are *increasing, subtract* these seconds from the True Dist., nearly; when they are *decreasing, add* them, the result will be the M. T. at Greenwich.

*Lunar* (Raper's Rigorous Method)

| | ° | ′ | ″ |
|---|---|---|---|
| Latitude .. .. | 51 | 31 | 11 N. |
| Thermometer .. | 49 | | |
| Barometer .. .. | 30 inches. | | |

*Date Nov. 22nd, 1879, P.M. at place of observation, Mars and ☽. Mars East of Meridian.*

| | H | M. | S. |
|---|---|---|---|
| Supposed. Time by Watch .. | 7 | 46 | 33 |
| Supposed. Accumulated Rate of Watch .. .. .. | | — | 29 |
| | 7 | 46 | 4 |
| Supposed. Error of Watch .. .. | | — | 8 |
| G. M. T. Nov. 22nd .. | 7 | 45 | 56 |

| | ° | ′ | ″ |
|---|---|---|---|
| ☽ Semid. (table 40) .. | | 15 | 2·5 |
| Augmentation (42) .. | | | 9·2 |
| ☽'s Aug. Semid. .. .. | | 15 | 11·7 |
| Mars' Declination .. | 17 | 28 | 23 N. |
| | 90 | 00 | 00 |
| Mars' Polar Dist. .. | 72 | 31 | 37 N. |
| | H. | M. | S. |
| Mars' R. A. .. .. .. | 2 | 56 | 15 |

| | ′ | ″ |
|---|---|---|
| ☽'s Hor. Par. Noon .. .. .. .. | 55 | 28·9 |
| Mid. .. .. .. .. .. .. .. .. | 55 | 11·2 |
| Variation in 12 hours .. .. .. .. | 00 | 17·7 |
| Correction (table 21) .. .. .. .. | 00 | 11·4 |
| Hor. Par. Noon .. .. .. .. .. | 55 | 28·9 |
| Hor. Par. corr. for G.D. .. .. = | 55 | 17·5 |
| Corr. for Lat. (41) .. .. .. .. | — | 6·7 |
| Reduced Hor. Par. .. .. .. = | 55 | 10·8 |

| | Art. Hor. ° | ′ | ″ |
|---|---|---|---|
| Mars' Observed Alt. | 80 | 21 | 30 |
| Index error .. .. | + | | 3 |
| | 2)80 | 21 | 33 |
| App. Alt. .. = | 40 | 10 | 46·5 |
| Refraction − 1′ 9·1″ / Par. in Alt. + 13″ | − | 0 | 56·1 |
| Mars' True Alt. = | 40 | 9 | 50·4 |

| | Art. Hor. ° | ′ | ″ |
|---|---|---|---|
| Observed Alt. ☽ .. | 78 | 30 | 54 |
| Index error .. .. | + | | 3 |
| | 2)78 | 30 | 57 |
| | 39 | 15 | 28·5 |
| Augt. Semid... .. | + | 15 | 11·7 |
| ☽'s App. Alt. = | 39 | 30 | 40·2 |
| ☽'s corr. in Alt. (39) | + | 41 | 25 |
| ☽'s True Alt. = | 40 | 12 | 5·2 |

| | H. | M. | S. |
|---|---|---|---|
| Sidereal Time at Mean Noon Nov. 22nd (Day.) .. | 16 | 4 | 24·24 |
| Acceleration for G. D. (23) .. 7 hours .. | | 1 | 9 |
| 45 min. .. | | | 7·39 |
| 56 sec. .. | | | ·15 |
| Mean ☉'s R. A. .. .. .. .. .. .. = | 16 | 5 | 40·78 |

| | ° | ′ | ″ |
|---|---|---|---|
| Observed Distance F.L. .. .. .. .. | 53 | 30 | 10 |
| Index error .. .. .. .. .. .. .. | + | 2 | 00 |
| | 53 | 32 | 10 |
| ☽'s Semid. Augmented .. .. .. = | | 15 | 11·7 |
| ☽'s Apparent Dist. .. .. .. .. = | 53 | 16 | 58·3 |

| | App. Alts. ° | ′ | ″ |
|---|---|---|---|
| Mars (+ 13·15″) .. | 40 | 11 | 00 |
| ☽'s (+19·8″) .. .. | 39 | 31 | 00 |
| Sum .. .. .. = | 79 | 42 | 00 |
| | 180 | 00 | 00 |
| Apparent Zenith Dists. .. .. | 100 | 18 | 00 |

| | True Alts. ° | ′ | ″ |
|---|---|---|---|
| Mars (+13·5″) .. | 40 | 10 | 3·9 |
| ☽'s (+19·8″) .. | 40 | 12 | 25 |
| Sum .. .. .. | 80 | 22 | 28·9 |
| | 180 | 00 | 00 |
| True Zenith Dists. .. | 99 | 37 | 31·1 |

| | | |
|---|---|---|
| Mars' App. Alt. .. .. .. .. .. | Sec. | 0·116916 |
| ☽'s App. Alt. .. .. .. .. .. | Sec. | 0·112698 |
| Mars' True Alt. .. .. .. .. .. | Cos. | 9·883184 |
| ☽'s True Alt. .. .. .. .. .. | Cos. | 9·882933 |
| Logarithmic Difference .. .. .. .. = | | 9·995731 |

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| Mars' True Alt. .. .. .. .. .. | 40 | 9 | 50 | | |
| Lat. .. .. .. .. .. .. .. | 51 | 31 | 11 | Sec. | 0·206039 |
| N.P.D. .. .. .. .. .. .. | 72 | 31 | 37 | Cosec. | 0·020516 |
| Sum .. .. .. .. .. .. 2) | 164 | 12 | 38 | | |
| ½ Sum .. .. .. .. .. .. | 82 | 6 | 19 | Cosin. | 9·137839 |
| ½ Sum − Alt. .. .. .. .. .. | 41 | 56 | 29 | Sin. | 9·825017 |
| | H. | M. | S. | | |
| Hour ∠ .. .. .. .. .. .. | 3 | 5 | 16 | = Log. Sin. sq. = 9·189411 | |
| Mars' R. . + 24 hours .. .. .. | 26 | 56 | 15 | | |
| | 23 | 50 | 59 | = R. A. of Merid. | |
| | 16 | 5 | 41 | Mean Sun's R. A. | |
| | 7 | 45 | 18 | = Mean Time at Place. | |
| | 7 | 45 | 51 | = G. M. T. by Lunar. | |
| | 00 | 00 | 33 | = Long. in Time = 00° 8′ 15″ West. | |

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| App. Dist. .. .. .. | 53 | 17 | 00 | (note 1·7″ added) | |
| App. Zenith Dists. .. | 100 | 18 | 00 | | |
| Sum .. .. = 2) | 153 | 35 | 00 | | |
| ½ Sum = .. .. .. | 76 | 47 | 30 | Sin. | 9·988356 |
| ½ Sum − App. Dist. = | 23 | 30 | 30 | Sin. | 9·600845 |
| Logarithmic difference .. .. .. .. = | | | | | 9·995731 |
| Arc $x$ .. .. .. .. | 76 | 38 | 52 | = {Sin. sq.} = 9·584932 | |
| True Zenith Dists. .. | 99 | 37 | 31·1 | | |
| Sum .. .. .. .. | 176 | 16 | 23·1 | | |
| Difference .. .. .. | 22 | 58 | 39·1 | | |
| ½ Sum .. .. .. .. | 88 | 8 | 11·5 | Sin. | 9·999770 |
| ½ Difference .. .. | 11 | 29 | 19·5 | Sin. | 9·299238 |
| Approx. True Dist. .. | 52° | 59′ | 49″ | = {Sin. sq.} = 9·299008 | |
| Seconds added .. .. | — | | 1·7 | | |
| True Dist. .. .. = | 52 | 59 | 47·3 | pro. Log. N.A. 2805 | |
| N.A. at VI. hours .. | 53 | 55 | 19 | | |
| Difference .. .. .. | | 55 | 31·7 | pro. Log.(74) 5108 | |
| | H. | M. | S. | | |
| Time of Dist. by N.A. .. | 6 | 00 | 00 | | |
| | 1 | 45 | 55 | = pro Log = 2303 | |
| | 7 | 45 | 55 | | |
| Correction for 2nd difference (57) | | | 4 | | |
| G. M. T. by Lunar .. | 7 | 45 | 51 | | |
| Time by Watch .. .. | 7 | 46 | 33 | | |
| Watch fast of G. M. T. = | | | 42 | | |

*Note.*—All the numbers of tables given in this example are Raper's, but the computations can be made by using Table XXXVI. and the other tables given in this book.

*To clear the Lunar Distance by Natural Cosines.*

Take the sum and difference of the apparent altitudes; also the sum and difference of the true altitudes. *When the sum of the altitudes is less than* 90°, add together the natural cosines (Table XXVIII.) of the sum and difference of the apparent altitudes; also the natural cosines of the sum and difference of the true altitudes.

*When the distance is less than* 90°, add together the natural cosine of the sum of the apparent altitudes and the natural cosine of the apparent distance. When the distance is greater than 90° take their difference, multiply this result by the sum of the natural cosines of the true altitudes, and divide the product by the sum of the natural cosines of the apparent altitudes; the result will be a quantity which call $x$; the difference between $x$ and the natural cosine of the sum of the true altitudes will be the natural cosine of the true distance when it is less than 90°, but when greater than 90°, deduct it from 180°, and the result will be the true distance.

*When the sum of the altitudes is greater than* 90°, instead of the *sums* of the natural cosines, of the sums and *differences* of the true and apparent altitudes, take their differences; $x$ is found as before, and is to be *added* to the natural cosine of the sum of the true altitudes, and the result will be the natural cosine of the true distance.

| | ° | ′ | ″ | | ° | ′ | ″ |
|---|---|---|---|---|---|---|---|
| Mars' App. Alt. .. .. .. .. .. | 40 | 11 | 00 | Mars' True Alt. .. .. .. .. .. | 40 | 10 | 04 |
| ☽'s App. Alt. .. .. .. .. .. | 39 | 31 | 00 | ☽'s True Alt. .. .. .. .. .. .. | 40 | 12 | 25 |
| Sum .. .. .. .. .. .. = | 79 | 42 | 00 | Sum .. .. .. .. .. .. = | 80 | 22 | 29 |
| Difference .. .. .. .. = | 00 | 40 | 00 | Difference .. .. .. .. .. = | | 2 | 21 |

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| Sum of App. Alts. .. .. | 79 | 42 | 00 | Nat. Cosine .. .. .. .. .. = | ·178802 |
| Diff. of App. Alts. .. .. | 00 | 40 | 00 | Nat. Cosine .. .. .. .. .. = | ·999932 |
| | | | | (1st Term).. .. .. .. .. .. = | 1·178734 |
| | ° | ′ | ″ | | |
| Sum of True Alts. .. .. | 80 | 22 | 29 | Nat. Cosine .. .. .. .. .. = | ·167204 |
| Diff. of True Alts... .. .. | 00 | 2 | 21 | Nat. Cosine .. .. .. .. .. = | ·999999 |
| | | | | (2nd Term) .. .. .. .. .. = | 1·167203 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sum of App. Alts. | ° | ′ | ″ | Nat. Cosine .. | = | ·178802 |
| App. Dist... .. | 53 | 16 | 58 | Nat. Cosine .. | = | ·597865 |
| | | | | (3rd Term) .. | = | ·776667 |

1·178734 : 1·167203 :: ·776667 : ·769069 = $x$

| | | | | | |
|---|---|---|---|---|---|
| | | | | Sum True Alts. Nat. Cosine = | ·167204 |
| | | | | $x$ = | ·769069 |
| | ° | ′ | ″ | | |
| True Distance | 52 | 59 | 47 | Nat. Cosine = | ·601865 |

*To compute the Altitude of a Heavenly Body.*

It frequently happens that, at the time when a lunar distance is required, the altitude of one, or both, of the bodies may be so high or so low as to prevent their being taken in an artificial horizon, in which case the altitude should be computed, the error of the watch on M. T. at place having been previously determined; and since the *Altitudes* employed in clearing the lunar distance are not required to the same degree of precision as those used in finding the time, it will be sufficient if they are computed within 20″ or 30″ of the truth.

*Rule.*—Having taken from the 'Nautical Almanac' the declination, R.A., Sidereal Time, Semi-diameter, Horizontal Parallax, &c., as required, correct the same for the *approximate* Greenwich Date.

Find the Hour Angle as follows:—

For the ☉ the apparent time from Noon is the Hour Angle. If P.M. the mean time at place converted into app. time with the equation of time will be the hour angle, but if A.M. the apparent time thus found, expressed astronomically, must be subtracted from 24 hours to give the hour angle.

For the Moon, Star, or a Planet:—

To the Sidereal time at noon on the given day (page ii. N. A.) accelerated for Greenwich date (Table XXXI.) add the mean time at place, this sum will be the Right Ascension of the Meridian; subtract from the R. A. of the Meridian the R. A. of the object, and the result will be the west hour angle of the object; which subtract from 24 hours when the east hour angle is required.

The True Altitude may now be computed as follows:—

*To find arc 1.*—To the log cosine of the object's hour angle add the log

cotangent of the latitude; their sum (rejecting 10 in the index) will be the log tangent of arc I.

*To find the true Altitude.*—Add together the log sine of the Latitude, the log secant of arc I., and the log cosine of the *difference* of arc I. and the Polar Dist.; their sum will be the log sine of the true Alt.

N.B.—When the hour angle is more than 6 hours, or 90°, take the log cosine of the *sum* of arc I. and the Polar Dist.

*From the True Altitude to find the Apparent Altitude*:—

The corrections must be applied in reverse order, and with contrary signs to those with which the true is derived from the Apparent Altitude.

*For the Sun or for a Planet.*—Subtract the Parallax in Altitude, and add the Refraction.

*For a Star.*—Add Refraction.

*For the Moon.*—Compute the parallax in altitude first by adding together the cosine of the true altitude and the log of the horizontal parallax (in seconds); the result will be the log of the parallax in altitude (nearly). *Subtract* this parallax from the true altitude, and with this corrected altitude again recompute the parallax in altitude; the parallax thus found must now be *subtracted* from the true altitude; with the remainder take out the refraction, which correct for temperature and barometer, and *add* it to the corrected altitude; the result is the apparent altitude.

### *Computation of ☽'s True Central Altitude.*

November 10th, 1899, at 7 h. 3 m. 23 secs. P.M., in Latitude 8° 48′ S., approximate Longitude 31° 6′ E., the distance between the sun and the moon was observed. The altitude of the moon was too great to be observed in an Artificial Horizon, it had therefore to be computed. The error of the watch on local mean time was 2 m. 8 secs. slow. Thermometer, 73° Fahr. Barometer, 27·4 inches.

| | | H. | M. | S. |
|---|---|---|---|---|
| Time by Watch .. .. .. .. | | 7 | 3 | 23 |
| Error of Watch.. .. .. .. | | + | 2 | 8 |
| Mean Time at Place .. | = | 7 | 5 | 31 |
| Longitude in Time .. .. | − | 2 | 4 | 24 |
| G. M. T. Nov. 10th .. .. | = | 5 | 1 | 7 |

| | | H. | M. | S. |
|---|---|---|---|---|
| Sidereal Time Mean Noon. Page ii. N.A. .. .. .. | | 15 | 17 | 42·54 |
| Acceleration 5 hours.. | = | | | 49·28 |
| Acceleration 1 min. .. | = | | | ·16 |
| Acceleration 7 secs. .. | = | | | ·02 |
| Red. Sid. Time .. .. | = | 15 | 18 | 32·00 |
| Mean Time at Place .. | + | 7 | 5 | 31 |
| R.A. of Meridian .. | = | 22 | 24 | 3·0 |
| ☽'s Red. R.A. .. .. | − | 21 | 23 | 52·35 |
| ☽'s Hour angle .. .. | = | 1 | 0 | 10·65 |

| | | H. | M. | S. |
|---|---|---|---|---|
| ☽'s R.A. at 5 hours | = | 21 | 23 | 49·85 |
| ☽'s R.A. at 6 hours | = | 21 | 26 | 4·29 |
| Hourly Variation .. | = | | 2 | 14·44 |

| | |
|---|---|
| Constant Log. .. .. .. .. .. | 9·5229 |
| Hourly Variation Pro Log. .. | 1·9049 |
| Mins. and secs. G. M. T. Pro Log. | 2·2073 |
| Corr. ☽'s R.A. + 2″·5 = Pro Log. | 3·6351 |

| | | H. | M. | S. |
|---|---|---|---|---|
| ☽'s R.A. at 5 hours .. | | 21 | 23 | 49·85 |
| Corr. ☽'s R.A. .. | + | = | | 2·50 |
| ☽'s Red. R.A. .. | = | 21 | 23 | 52·35 |

| | | ° | ′ | ″ |
|---|---|---|---|---|
| ☽'s Declination at 5 hrs. | | 10 | 34 | 12·8 S. |
| Corr. by var. in 10 m... | | | − | 13·9 |
| ☽'s Red. Decl. .. | = | 10 | 33 | 58·9 S. |
| | | 90 | 00 | 00 |
| P. D... .. .. .. .. | = | 79 | 26 | 1·1 |
| Arc (1) .. .. .. .. | | 80 | 53 | 34·0 |
| Difference .. .. | = | 1 | 27 | 32·9 |

| | ′ | ″ |
|---|---|---|
| ☽'s Hor. Par. Noon .. .. | 59 | 11·02 |
| ☽'s Hor. Par. Mid. .. .. | 59 | 15·64 |
| 12 Hours' Variation .. .. | | 4·62 |

| | ′ | ″ |
|---|---|---|
| ☽'s Hor. Par. Noon or Mid .. | 59 | 11·02 |
| Corr. by 12 hourly variation | + | 1·9 |
| | 59 | 12·92 |
| Corr. for Lat. (Table XXXIV.) | − | ·2 |
| ☽'s Reduced Hor. Par... .. | 59 | 12·72 |

(*Continued on p. 194.*)

| | | | | | | |
|---|---|---|---|---|---|---|
| | H. | M. | S. | | | |
| ☽'s Hour ∠ .. .. .. | 1 | 0 | 11 | | Cosine = | 9·984851 |
| | ° | ′ | ″ | | | |
| Latitude .. .. .. .. | 8 | 48 | 0 | | Cotan. = | 10·810206 |
| Arc (1) .. .. .. .. | 80 | 53 | 34 | = | Tang. = | 10·795057 |

| | ° | ′ | ″ | | | |
|---|---|---|---|---|---|---|
| Latitude .. .. .. .. .. | 8 | 48 | 0 | | Sin. = | 9·184651 |
| Arc (1) .. .. .. .. | 80 | 53 | 34 | | Sec. = | 10·800566 |
| S. P. D. ∾ Arc 1 .. .. | 1 | 27 | 32·9 | | Cosine = | 9·999859 |
| ☽'s True Central Alt. .. | 75 | 3 | 58 | = | Sin. = | 9·985076 |

For Parallax in Altitude.

| | ° ′ ″ | | | |
|---|---|---|---|---|
| True Alt. .. .. .. .. .. | 75 3 58 | | Cos. = | 9·411121 |
| Red. hor. par. .. .. .. | ″ ..3552·72 | | Log. = | 3·550560 |
| Par. in Alt. nearly .. .. | ″ .. 915·55 | = | Log. = | 2·961681 |

| | ° | ′ | ″ |
|---|---|---|---|
| True Alt. .. .. .. .. .. .. | 75 | 3 | 58·00 |
| Par. in Alt. nearly .. .. .. .. | − | 15 | 15·55 |
| Approx. App. Alt. .. .. .. .. = | 74 | 48 | 42·45 |

| | ° ′ ″ | | |
|---|---|---|---|
| Approx. App. Alt. .. | 74 48 42·45 | Cos. | 9·418284 |
| Red. hor. par. .. .. .. | ″ 3552·72 | Log. | 3·550560 |
| Parallax in Altitude .. .. | ″ ..930·78 | Log. | 2·968844 |

| | ° | ″ | ″ |
|---|---|---|---|
| ☽'s true central Alt. .. .. .. .. | 75 | 3 | 58·00 |
| Parallax in Altitude .. .. .. .. | − | 15 | 30·78 |
| | 74 | 48 | 27·22 |
| Corrected refraction .. .. .. .. | | + | 15·62 |
| ☽'s Apparent Altitude .. .. .. | 74 | 48 | 42·84 |

*Longitude by Moon Culminating Stars.*

The observation can be taken with the transit theodolite, which must, however, be accurately set up in the plane of the meridian. This can be done by either of the following methods:—

*By Meridian Passage of the Pole Star.*—Find the mean time of the meridian passage of the pole star in the manner shown on p. 140. Level the instrument, and if this be carefully done the line of collimation will move in a plane perpendicular to the horizon, and will pass through the zenith, then by making it also pass through the celestial pole, and clamping the horizontal plates when it is in that position, the movements of the telescope will be restricted to the plane of the meridian. This is done by turning the telescope on to the pole star, and covering it with the point of intersection of the telescope wires at the time (previously ascertained) of its upper or lower culmination, and then firmly clamping the horizontal plates. The meridian line should now be laid out to the north and south of the observer by sending a man with a lantern and a staff in both directions, and making him drive the staff into the ground at the spot where the observer sees the lantern in a central position on the cross wires of the telescope.

*By High and Low Stars.*—This method is accurate, and will be found convenient when the pole star cannot be observed. Having placed the instrument approximately in the meridian, choose two stars differing *considerably* in declination, and but *little* in right ascension. Note carefully the time that each star passes the central wire; take the difference of these times, to which apply the rate of the watch, due for the interval, and convert this into a sidereal interval by Table XXXI., or by the 'Nautical Almanac' table of time equivalents. Take from the 'Nautical Almanac' the apparent right ascensions of the stars, and subtract the less from the greater. If this difference agrees exactly with the sidereal interval obtained by the watch, the telescope will move in the meridian, but when the transit of the high star has been observed first, and this is not the case, and the interval shown by the watch is less than the difference of the stars' right ascensions, the telescope must be moved to the

*west;* if the contrary be the case the telescope must be moved to the *east.* When the transit of the low star is observed first and the interval shown by the watch is less than the difference of the stars' right ascension, the telescope must be moved to the east; if the contrary is the case, the telescope must be moved to the west. This must be repeated until the sidereal interval, computed from the watch times of transit, and the difference of the stars' right ascensions taken from the 'Nautical Almanac,' agree exactly; the telescope will then move in the plane of the meridian. Select a star as near the zenith as possible for the "high star," as when the instrument is truly level the telescope will be on the meridian when pointing to the zenith, no matter how much it may differ from the meridian when in any other position.

*By Meridian Passage of any Star.*—Any star may be used if the local time is accurately known, and the time of the star's meridian passage carefully computed (as shown p. 140). The observation is precisely the same as for the pole star, but it would be well to take more than one star in order to correct any errors that may have been made in observation or computation. Though the results of such observations as this are susceptible of a great degree of precision, yet absolute accuracy must not be expected.

*By Stars East and West of the Meridian.*—If local time is not accurately known, the true meridian may be found in the following manner:—Carefully level the transit theodolite, and set the 360° division as nearly *true* north as you can get it by the attached magnetic needle, then clamp the lower plate, and unclamp the vernier plate; select any star at some considerable distance east of the meridian, and cover it with the intersection of the threads in the diaphragm, *clamp the vertical circle,* and take the reading on the horizontal plate; then, after the necessary interval, watch the star until it is again covered with the intersection of the threads in the diaphragm west of the meridian, take the reading, and then the theodolite will point just as far west of the meridian as it originally did to the east, and a point midway between these two horizontal readings will be in the true meridian. Care must be taken to keep the vertical circle and the lower plate clamped during the interval between these two observations. Having thus found the true meridian it can be marked as previously directed. Owing to the constant change in the sun's declination it is unsuited for finding the meridian by this method.

In the following:—

Æ indicates right ascension of the heavenly body.
☽| „ the moon's bright limb.
T′ „ approximate longitude in time.
T „ longitude in time.
C „ the difference of Æ.
B „ the mean of the second differences of Æ.

*The Observation:*—Having the instrument set in the plane of the meridian, proceed as follows:—

From the list of "Moon Culminating Stars," given in the 'Nautical Almanac,' select the star whose transit you intend to observe, and calculate the local mean time of its meridian passage in the manner shown on p. 140. Take from the 'Nautical Almanac,' page IV., the moon's meridian passage (upper), and from this subtract the time of the moon's semi-diameter passing the meridian, *before full moon*, but add it *after full moon*, the result will be the mean time of transit of the moon's bright limb; but if the meridian of place of observation is at any great distance from the meridian of Greenwich, or any other meridian, from which the difference of the longitude is to be found, then it will be necessary to correct this in the manner shown in the explanation of page IV., given at the end of the 'Nautical Almanac.' All this should be done some time before the transits are to be observed.

If the instrument is fitted, as it should be, for taking transits, it will have four wires, one horizontal and three vertical, in the place of the usual web, and the exact time of the contact of both the moon's bright limb and the star must be observed at each of the three vertical wires, and the means taken as the true time of observed transit. Be sure to be ready at the instrument some time before the first object comes to the meridian, and make a note of the difference between the declination of the moon and the star, as when the moon transits before the star, it will only be necessary to move the vertical circle by that amount to ensure the star coming into the middle of the field, but if the star transits first, its altitude must be computed beforehand, and for this the latitude must be known, thus:—Add together the complement of the latitude of the place of observation and the declination of the star, when they are of the same name, or taking their difference when of contrary names; the altitude to be reckoned from the south point of the horizon when the latitude is

north, and the contrary when south; but when the sum exceeds 90° it is to be taken from 180°, and the altitude is to be reckoned from the north in north latitude, and the south in south latitude.

Having taken the observation, take the difference between the observed mean of the times of transit of the ☽| and ✱, this will be the mean time interval; accelerate this (Table XXXI., or Time equivalents N.A.), and the result will be the sidereal interval.

Put down the Æ of the star observed, and under this put the sidereal interval just found. When the moon transits *before* the star *subtract* the interval from the star's Æ, but when the moon transits *after* the star *add* it, and the result will be the Æ of the moon's bright limb at transit at place, under which put the nearest Æ of the moon's bright limb, taken from col. 4 (N.A.) "Moon Culminating Stars," and take the difference, which turn into seconds and decimals of a second, and call C.

Take from the fourth column of the table of "Moon Culminating Stars" (N.A.) the Æ of the moon's bright limb for four successive culminations, so that two may precede and two follow the Æ of moon's bright limb at transit at place of observation; put these below each other in regular order, and subtract each of these quantities from the following for the "First Differences," and called the middle term A; subtract each "of the First Differences" from the following for the "Second Differences," and take half the sum, or mean of the "Second Differences," and call it B. The subtraction necessary to obtain the "differences" must be made as in algebra, i.e., by changing the sign of the quantity to be subtracted, and giving the result the sign of the greater quantity; take care to prefix the proper sign to B.

It should be remembered that the right ascensions of the moon's bright limb, taken from the 'Nautical Almanac,' must be those of the same limb (I. or II.)* as that observed. Near the full moon, when the limb marked in the 'Nautical Almanac' changes from I. to II., there may be one or two right ascensions not marked for the limb required. In this case the requisite right ascensions may be found by adding to, or subtracting from, the right ascension of the limb given in the 'Nautical

* The Roman figures I. and II. indicate the limbs of the moon which come first or last to the meridian.

Almanac,' *twice* the sidereal time of the moon's semidiameter passing the meridian (col. 7 "Moon Culminating Stars," 'Nautical Almanac'), and the result will be the right ascension of the other limb.

To the constant log 4·635480 (the log of 12 hours expressed in seconds) add the ar-co-log of arc A expressed in seconds, and the log of C; the sum of these three logs, rejecting 10 in the index, will be the log of approximate longitude in time, which call T′.

Enter table No. XXII. with B at the top, and the approximate longitude in time, T′, at the side, and find the corresponding correction, to the log of which add the constant log 4·635480 and the ar-co-log of A, and the sum, rejecting 10 in the index, will be the log of the correction to be applied to the approximate longitude in time with the same sign as B, and thus the correct value of T will be obtained, which will express the longitude of the place if it be west of Greenwich, but if the longitude is east we must subtract this value of T from 12 hours to obtain the true longitude in time east of Greenwich.

In taking this observation it is essential that the axis on which the telescope turns be made horizontal. This is tested with the striding level, and the necessary correction obtained in the following manner.

When the striding level is in perfect adjustment and placed on a truly horizontal axis of the instrument, the bubble will be in the centre of its run. Should this not be the case, and if with the level in perfect adjustment the bubble does not return to the centre of its run when reversed, the axis is not truly horizontal, and the inclination must be measured by the number of divisions. Place the striding level on the pivots and read the scale at the extremities of the air bubble. Reverse the bubble and again read the scale in the same manner; that is with the same end of the level on both east and west pivots alternately. This operation should be repeated several times in order to diminish the effect of incidental errors. Half the difference of the means of the readings will be the amount of the deviation. The maker should supply the value in arc of the divisions on the level, but should he neglect to do so the value may be obtained by placing the level lengthwise on the telescope and measuring the effect of changes of level on the graduated vertical arc.

*Example.*

August 17th, 1899, the transits of the ☽ and the ✱ B. A. C. 6550 were taken over three wires of a transit theodolite to determine the longitude of the place; times being taken by an ordinary watch.

| | Transit of ☽ H. M. S. | | Transit of ✱ H. M. S. |
|---|---|---|---|
| Mean of the Times | 8 49 57·8 | Mean of the Times | 9 20 35·0 |

| | H. | M. | S. |
|---|---|---|---|
| Obsd. Local M. T. of Transit of B. A. C. 6550 .. .. .. .. | 9 | 20 | 35·0 |
| Obsd. Local M. T. of Transit of ☽ .. .. .. .. .. | 8 | 49 | 57·8 |
| Mean Time Interval .. .. = | 0 | 30 | 37·2 |
| Acceleration .. .. .. .. .. | | + | 5·03 |
| Sidereal Interval .. .. = | 0 | 30 | 42·23 |

| | H. | M. | S. |
|---|---|---|---|
| Greenwich Transit of B. A. C. 6550 on Aug. 17th, 1899 [✱'s R.A. col. 4, "Moon-Culminating Stars" (N.A.)] .. | 19 | 3 | 55·30 |
| Sidereal Interval – because ☽ transits before star .. .. | – | 30 | 42·23 |
| R.A. of ☽ at Transit at Place | 18 | 33 | 13·07 |
| Nearest R.A. of ☽ (col. 4 N.A.) | 18 | 32 | 41·05 |
| Diff. of R.A. = C. = | | 0 | 32·02 |

| | Day. | Aug. 1899. | H. | M. | S. | 1st Diff. M. S. | 2nd Diff. secs. |
|---|---|---|---|---|---|---|---|
| 2 preceding R.A. of ☽ | 16th | L. C. | 18 | 0 | 15·87 | | |
| | 17th | U. C. | 18 | 32 | 41·05 | + 32 25·18 | |
| 2 following R.A. of ☽ | 17th | L. C. | 19 | 5 | 4·68 | A + 32 23·63 | – 1·55 |
| | 18th | U. C. | 19 | 37 | 14·35 | + 32 9·67 | – 13·96 |
| | | | | | | 2) | 15·51 |
| | | | | | | B = | – 7·75 |

| | | | |
|---|---|---|---|
| Constant Log. .. .. .. .. .. .. .. .. | = 4·635480 | .. .. .. .. .. .. .. .. | 4·635480 |
| A in seconds .. = 1943·63 Ar. Co. Log. | = 6·711387 | .. .. .. .. .. .. .. .. | 6·711387 |
| C " .. .. 32·02 .. .. Log... | = 1·505421 | Equation from table XXII. s. = 0·1 log... .. .. .. .. | $\bar{1}$ 000000 |
| Approx. Longitude secs. 711·71 .. = Log... = | 2·852288 | Correction – secs. 2·22 = Log. = | 0·346867 |

Correction .. .. – 2·22

Longitude in Time = 709·49 = 2° 57′ 22″ W.*

* The Longitude is *West* because the ☽'s Æ at Transit at place is *greater* than the ☽'s Æ at the *nearest* U. C. (upper culmination) at Greenwich (which in this case was 0h. 45m. 54·39s.). If the ☽'s Æ at Transit at place had been *less* than the *nearest* U. C. at Greenwich, the Longitude would have been East.

*To find Level Error the following readings were taken. Value of each division* 1″·33.

| | | | |
|---|---|---|---|
| Level readings at East End .. .. | 28·2 | At West End .. .. | 33·2 |
| | 28·1 | | 33·3 |
| Level reversed .. .. .. .. .. .. | 28·2 | Level reversed .. .. | 33·1 |
| | 28·3 | | 33·2 |
| Sum | 112·8 | Sum | 132·8 |
| | | | 112·8 |
| | | 4) | 20·0 |
| | | 2) | 5·0 |

½ the difference of the means = to the amount of deviation = 2·5 divisions.

| | ″ |
|---|---|
| Value of each division .. .. .. .. .. .. .. | 1·33 |
| | 2·5 |
| | 665 |
| | 266 |
| 5) | 3·325 |
| 3) | ·665 |
| Deviation in Time .. .. .. .. .. .. .. = | ·222 = Sec. of Time. |

*To find the Correction, due to level error, to be applied to observed time of Transit.*—At Mitcham, on January 10th, 1894, *α Orionis* was observed to transit at 10h. 27m. 30·5 secs. The level error was + 2·5 divisions of 1″·33 each, or in time 0·222 sec. The declination of *α Orionis* was 7° 23′ 19″·2 N. Latitude of Mitcham 51° 24′ 5″ N.

| | | ° | ′ | ″ | |
|---|---|---|---|---|---|
| Lat. Mitcham .. .. .. .. .. .. .. .. .. | | 51 | 24 | 5 | N. |
| Declination α Orionis .. .. .. .. .. .. | | 7 | 23 | 19·2 | N. |
| Meridian Z. D. of α Orionis .. .. .. .. | = | 44 | 00 | 45·8 | |

| | | |
|---|---|---|
| 0·222 sec. .. .. .. .. .. .. .. .. .. | Log. | $\bar{1}$·346353 |
| Z. D. = 44° 0′ 45·8″ .. .. .. .. .. | Cos. | 9·856840 |
| Decl. 7° 23′ 19·2″ .. .. .. .. .. .. | Sec. | 0·003621 |
| Correction = 0·161 sec. .. .. .. .. .. .. | | $\bar{1}$·206814 |

The West end of the axis being too high, the correction is +; therefore we get—

| | | H. | M. | S. |
|---|---|---|---|---|
| Obsd. Time .. .. .. .. .. .. .. .. .. | | 10 | 27 | 30·5 |
| Correction .. .. .. .. .. .. .. .. | | | + | 0·16 |
| Correct Time of Star's Transit .. .. | = | 10 | 27 | 30·66 |

The method of Moon Culminating Stars, *which is entirely independent either of local or Greenwich time,* includes all that is necessary to find the difference of longitude between any two meridians where observations have been taken, but as the elements in the 'Nautical Almanac' have been most accurately computed, it is better to take Greenwich as the other meridian.

The principle upon which the longitude is found in this method is similar to that which is used in a common lunar observation, and depends on the observed motion of the moon; but in the present problem, this motion is ascertained by observing the time when the moon's bright limb passes the meridian, instead of measuring the angular distance of the moon from the sun, star, or planet. The variation of the moon's right ascension, corresponding to a change of 15° in the longitude, is given very accurately by the 'Nautical Almanac' for every transit of the moon's limb at Greenwich. This variation is about 2m. in time for 1h. of longitude, and when the difference of the times of transit under different meridians has been found by observation, it is easy to obtain the corresponding longitude.

*To find the Longitude by Eclipses of Jupiter's Satellites.**

In the 'Nautical Almanac' will be found the configuration of Jupiter's satellites for every day in the year, except when Jupiter is so close to the sun that his satellites are invisible; these diagrams are given for north latitude, and must be reversed for south latitude. When Jupiter comes to the meridian before midnight, the whole eclipse (both immersion and emersion) takes place on the *east* side of the planet; when after midnight, on the *west* side. As an inverting eye-piece must be used, this will appear to be reversed. The error of the watch on mean time at place should be found from observations of the sun's, or a fixed star's altitude; but if Jupiter is more than 3 hours from the meridian at the time of

* "This method, though easy and convenient, is not very accurate; the eclipse is not instantaneous, and the clearness of the air, and the power employed, affect considerably the time of the phenomenon. Observers have been found to differ 40 secs. or 50 secs. in the same eclipse."—*Raper.*

making the immersion or emersion of one of his satellites, and if Jupiter's altitude be taken at the instant of observing the immersion or emersion, the use of a watch will be unnecessary, as the 'Nautical Almanac' will furnish the Greenwich date required; this, of course, can only be done when there are two observers. As a rule, the *first* satellite is to be preferred, as its motion is more rapid than that of the other three. The explanations given in the 'Nautical Almanac' are so clear that they leave nothing to be added.

*The Observation.*—Having estimated the local time of the phenomenon with the assumed longitude, and the time given in the 'Nautical Almanac,' be ready some time before the eclipse will take place, with a telescope having a magnifying power of not less than 40, and note the instant of the disappearance or re-appearance of the satellite. It must be remembered that either of these events (being caused by the shadow of the planet) may take place when the satellite is at a considerable distance from Jupiter. The difference between mean time at place when the observation was taken, and the mean time at Greenwich given in the 'Nautical Almanac,' is the longitude as shown in the following example:—

January 6th, 1899, observed the immersion of the 1st satellite of Jupiter at 7h. 20m. 30secs., watch 22m. 30secs. slow of local mean time.

| | H. | M. | S. | | ° | ′ | ″ | |
|---|---|---|---|---|---|---|---|---|
| Time by Watch .. .. .. .. .. .. .. | 7 | 20 | 30 | | | | | |
| Error of Watch .. .. .. .. .. .. + | | 22 | 30 | | | | | |
| | 7 | 43 | 00 | | | | | |
| M. T. at Greenwich ('Nautical Almanac') | 4 | 7 | 29 | | | | | |
| Longitude in Time .. .. .. .. .. .. | 3 | 35 | 31 | = | 53 | 52 | 45 | E. |

## Observations for Bearings.

*To find the True Bearing of a peak or any other object by means of its observed angular distance from the sun.*

Observe the sun's altitude, then the angles between the object and the nearer and farther limbs, and lastly the sun's altitude again; noting the times of each contact. If the object has any altitude observe it, and note whether it is east or west of the sun. Half the sum of the times of the observed angular distances is the mean time of the observation, and half the sum of the angles observed is the apparent angle; but if the farther limb, only, be observed, the apparent angle is found by subtracting the sun's semi-diameter; or if the nearer limb, by adding. From the observed altitudes of the sun, the altitude at the time of the observed angle is found by Simple Proportion.

With time at place find Greenwich date, either by the error and rate of the watch, or with the longitude in time.

Take the declination from the 'Nautical Almanac' (if *App.* time is used, Page I.; if *Mean* time, Page II.); correct this for the Greenwich date. From the observed altitude, find the *True Alt.*

$$\text{Add together}\left\{\begin{array}{l}\textit{True Altitude,}\\ \textit{Latitude,}\\ \textit{Polar Distance;}\end{array}\right.$$

divide their sum by 2 for the half sum, and take the difference between the polar distance and the half sum, which call remainder.

$$\text{Add together}\left\{\begin{array}{l}\textit{Log secant of the Altitude,}\\ \textit{Log secant of the Latitude,}\\ \textit{Log cosine of } \tfrac{1}{2} \textit{ sum,}\\ \textit{Log cosine of remainder,}\end{array}\right\}\begin{array}{c}\text{rejecting 30 from}\\ \text{the index.}\end{array}$$

Take out the log sine square of the sum of these four logs (table 69, Raper), or divide the sum by 2, and it will give the log sine of half the

true azimuth, which multiply by 2; in either case the result will be the sun's true bearing. If the observed object has an altitude,

Add together $\left\{\begin{array}{l}\textit{Log sine of object's alt.,}\\ \textit{Log sine of ⊙'s app. alt.,}\\ \textit{Log cosec. of app. angle,}\end{array}\right\}$ rejecting 20 from the index,

and take out the sum as a log sine: the result is the corrected angle.

If the observed object has no altitude, or if its altitude is very small, this step is neglected, and the apparent angle is used as the corrected angle.

Find the apparent alt. from the true alt. already found, from the observed angular distance find the apparent distance, and from the cos of the dist. from ⊙'s centre, subtract the cos of the apparent altitude; the remainder will be the cos of difference of bearings. If the sun be *East* of the meridian, and the object more *East*, or the sun be *West*, and the object more *West*, *add* the difference of bearing thus found to the ⊙'s true bearing. In any other case, take the difference between the sun's true bearing and the difference of bearings, and the result is the true bearing of the object.

When this observation is taken with a transit theodolite, the object, the bearing of which is required, is made zero before taking the altitudes, and the horizontal verniers are read after taking each altitude. As this gives the *horizontal* angle between the object and the sun, it will only be necessary to compute the sun's true bearing; and by applying the horizontal angle to this, the true bearing of the object is obtained, and the latter part of the work given in the sextant example will be unnecessary.

*Example of Sextant Observation.*

$$\text{Cos difference of bearings} = \frac{\text{Cos apparent distance}}{\text{Cos apparent alt. of } \odot}$$

July 15th, 1899, P.M. at place, angles and altitudes taken with a sextant.
Lat. 51° 24′ N., Long. 0° 9′ 35″ W. Index error − 2′ 10″.

| Time. | H. | M. | S. |
|---|---|---|---|
| | 3 | 13 | 18 |

| Obsd. Alt. in Quicksilver. | ° | ′ | ″ |
|---|---|---|---|
| | 87 | 45 | 00 |

| | ° | ′ | ″ |
|---|---|---|---|
| Obsd. Angular distance of an object, East of the Sun .. | 109 | 12 | 10 |

| Year. Month. Day. | H. | M. | S. |
|---|---|---|---|
| 1899, July 15 .. .. | 3 | 13 | 18 |
| Error of Watch .. .. .. | − | 0 | 13 |
| G. M. T. July 15 (Month. Day.) .. | 3 | 13 | 5 |

| Month. Day. | ° | ′ | ″ |
|---|---|---|---|
| Declination July 15th (Page ii. N.A.) | 21 | 32 | 2·8 N. |
| Correction by Hourly Diff. for G.M.T. | − | 1 | 15·7 |
| | 21 | 30 | 47·1 N. |
| | 90 | 00 | 00 |
| North Polar Dist. .. .. .. = | 68 | 29 | 12·9 |

| | ° | ′ | ″ |
|---|---|---|---|
| Obsd. Alt. in Quicksilver ⊙ | 87 | 45 | 00 |
| Index Error .. .. .. .. .. | − | 2 | 10 |
| | 2)87 | 42 | 50 |
| Obsd. Alt. .. .. .. .. .. | 43 | 51 | 25 |
| Refraction .. .. .. .. .. | − | 1 | 0·9 |
| | 43 | 50 | 24·1 |
| Semidiameter .. .. .. .. | + | 15 | 45·6 |
| | 44 | 6 | 9·7 |
| Parallax .. .. .. .. | | + | 5·9 |
| True Alt. .. .. .. .. .. | 44 | 6 | 15·6 |

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| ⊙'s True Altitude | 44 | 6 | 15·6 | Sec. | 0·143831 |
| Latitude .. .. .. .. | 51 | 24 | 00 | Sec. | 0·204899 |
| N. Polar Distance .. | 68 | 29 | 12·9 | | |
| | 2)163 | 59 | 28·5 | | |
| ½ Sum .. .. .. .. | 81 | 59 | 44·2 | Cos. | 9·143804 |
| ½ Sum ∼ N. P. Dist. | 13 | 30 | 31·3 | Cos. | 9·987815 |
| ⊙'s True Bearing = Log. Sin. Square = S. 66° 42′ W. .. .. .. .. .. .. | | | | | 9·480349 |

| | ° | ′ | ″ |
|---|---|---|---|
| Obsd. Alt. ⊙ .. .. .. .. | 43 | 51 | 25 |
| Semidiameter .. .. .. .. | + | 15 | 45·6 |
| Apparent Alt. ⊙ .. .. .. | 44 | 7 | 10·6 |

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| Observed angular distance of object from the near limb of the sun, *corrected for Index error* .. .. .. .. .. | 109 | 10 | 00 | | |
| ⊙'s Semidiameter .. .. .. .. .. .. .. .. .. .. | + | 15 | 45·6 | | |
| Distance from ⊙'s centre .. .. .. .. .. .. .. .. = | 109 | 25 | 45·6 | Cos. .. .. .. .. .. | 9·521981 |
| ⊙'s Apparent Altitude .. .. .. .. .. .. .. .. .. | 44 | 7 | 10·6 | Cos. .. .. .. .. .. .. | 9·856057 |
| Difference of Bearings .. .. .. .. .. .. .. .. = | 62 | 23 | 44 | Cos. .. .. .. .. = | 9·665924 |
| | *180 | 00 | 00 | | |
| | 117 | 36 | 16 | | |

| | | ° | ′ | ″ |
|---|---|---|---|---|
| True bearing of ⊙ .. .. .. .. | S. | 66 | 42 | 00 W. |
| Object E. of ⊙ .. .. .. .. .. .. | | 117 | 36 | 16 |
| True Bearing of Object .. = | S. | 50 | 54 | 16 E. |

* If the obsd. angular distance is greater than 90°, subtract this difference of bearings from 180°.

*To find True Bearing of an Object. Example of Theodolite Observation.*

May 30th, 1899, A.M. The following observations were taken with a transit theodolite to determine the true bearing of the Flag Staff, Victoria Tower. Watch 36 secs. slow of G. M. T. Object East of the sun. Latitude 51° 30′ 30″; Ther. 63°; Bar. 30·2 inches.

**Times by Watch.**

| | H. | M. | S. |
|---|---|---|---|
| | 11 | 37 | 33 |
| | 11 | 43 | 18 |
| | 11 | 48 | 57 |
| | 11 | 52 | 00 |
| 4) | | 181 | 48 |
| | 11 | 45 | 27 |
| Watch slow of G. M. T. … | | + | 36 |
| Greenwich Date, May 29th … | 23 | 46 | 3 |

**Altitudes ☉. Transit Theodolite.**

| | ° | ′ | ″ | | ° | ′ | ″ |
|---|---|---|---|---|---|---|---|
| | | | | F. L. | 59 | 43 | 50 |
| F. R. | 30 | 5 | 30 | = | 59 | 54 | 30 |
| F. R. | 30 | 1 | 10 | = | 59 | 58 | 50 |
| | | | | F. L. | 59 | 59 | 30 |
| | | | | 4) | | 216 | 40 |
| | | | | | 59 | 54 | 10 |
| Corrected refraction | | | | | − | 0 | 32·8 |
| | | | | | 59 | 53 | 37·2 |
| Semidiameter .. | | | | | + | 15 | 47·9 |
| | | | | | 60 | 9 | 25·1 |
| Parallax .. .. .. | | | | | | + | 4·2 |
| True Alt. .. .. | | | | | 60 | 9 | 29·3 |

**Angles between Sun's near limb and object.**

| | ° | ′ | ″ |
|---|---|---|---|
| | 27 | 53 | 00 |
| | 30 | 33 | 30 |
| | 33 | 21 | 30 |
| | 34 | 37 | 00 |
| 4) | 126 | 25 | 00 |
| | 31 | 36 | 15 |
| Semidiameter .. .. | + | 15 | 48 |
| Angle from Sun's centre to object .. .. .. | 31 | 52 | 3 |

| | ° | ′ | ″ | |
|---|---|---|---|---|
| ☉'s Declination May 30th (P. ii. N. A.) .. | 21 | 47 | 1·3 | N. |
| Correction .. .. .. .. .. .. .. .. | | − | 5·1 | |
| Declination corrected for G. M. T. .. = | 21 | 46 | 56·2 | N. |
| | 90 | 00 | 00 | |
| N. Polar Distance .. .. .. .. .. .. .. | 68 | 13 | 3·8 | |

| | ″ |
|---|---|
| Variation in 1 hour .. | 22·26 |
| | ·23 |
| | 6678 |
| | 4452 |
| | 5·1198 |

| | ° | ′ | ″ | | | |
|---|---|---|---|---|---|---|
| True Altitude .. .. .. .. .. | 60 | 9 | 29·3 | | | |
| Latitude .. .. .. .. .. .. | 51 | 30 | 30 | Secant .. .. .. .. .. | | 0·303112 |
| Polar Dist... .. .. .. .. .. | 68 | 13 | 3·8 | Secant .. .. .. .. .. | | 0·205930 |
| 2) | 179 | 53 | 3·1 | | | |
| ½ sum.. .. .. .. .. .. .. | 89 | 56 | 31·6 | Cosine .. .. .. .. .. | | 7·004472 |
| ½ sum ∼ Polar Dist. .. .. | 21 | 43 | 27·8 | Cosine .. .. .. .. .. | | 9·968004 |
| Azimuth .. .. .. = S. | 6 | 18 | 40 E. | *Log. sine square | = | 7·481518 |

| | | ° | ′ | ″ |
|---|---|---|---|---|
| ☉'s True Azimuth | S. | 6 | 18 | 40 E. |
| Angle between Sun's centre and object E. of Sun .. .. | + | 31 | 52 | 3 |
| True bearing of Flag Staff .. = | S. | 38 | 10 | 43 E. |

* See note, p. 154.

*Finding the error of Compass by ☉'s Azimuth.*

The observation for finding the sun's true bearing and error of the compass is the same as that for finding apparent time, with the addition that the bearing of the sun's centre, at the time of observation, must be taken with a prismatic or other compass.

*Example.*

July 25th, 1899, A.M. The following observations were taken with a sextant to find the error of the compass:—Watch 8 secs. slow of G. M. T.; Index error − 2′; Ther. 80°; Bar. 29·7 inches. Bearings taken with prismatic compass.

| | ° | ′ | ″ |
|---|---|---|---|
| Latitude .. .. | 51 | 4 | 24 N. |

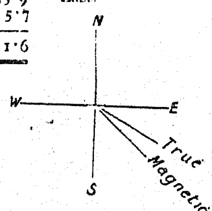
| Times by Watch. | H. | M. | S. |
|---|---|---|---|
| | 9 | 38 | 40 |
| | | 41 | 15 |
| | | 43 | 43 |
| 3) | | 123 | 38 |
| Mean.. .. .. .. .. .. = | 9 | 41 | 12·7 |
| Error of Watch .. .. .. + | | 0 | 8 |
| G. M. T., July 24th .. .. | 21 | 41 | 20·7 |

| | ° | ′ | ″ | |
|---|---|---|---|---|
| ☉'s Declination, July 25th (P. ii. N. A.) | 19 | 39 | 44·7 | N. decreasing. |
| Corr. by Hourly Diff. | + | 1 | 14·4 | |
| Reduced Declination | 19 | 40 | 59·1 | N. |
| | 90 | 00 | 00 | |
| N. Polar Distance = | 70 | 19 | 00·9 | |

| Alt. ☉ Art. Horizon. | ° | ′ | ″ |
|---|---|---|---|
| | 93 | 22 | 0 |
| | 94 | 2 | 0 |
| | 94 | 42 | 0 |
| 3) | 282 | 6 | 0 |
| Mean .. .. = | 94 | 2 | 0 |
| Index Error | − | 2 | 0 |
| 2) | 94 | 0 | 0 |
| | 47 | 0 | 0 |
| Corr. Refraction | | − | 50·5 |
| | 46 | 59 | 9·5 |
| Semi-diameter .. | + | 15 | 46·4 |
| | 47 | 14 | 55·9 |
| Parallax .. .. | | + | 5·7 |
| True Alt. .. = | 47 | 15 | 1·6 |

| Bearings of ⊕. | ° | ′ | ″ |
|---|---|---|---|
| | 137 | 55 | |
| | 138 | 39 | |
| | 139 | 22 | |
| 3) | 415 | 56 | |
| *Mean = | 138 | 38 | 40 |
| | 180 | 00 | 00 |
| | S. 41 | 21 | 20 E. |

N.B. — When the True Azimuth is to the left of the magnetic, the variation is West; when True Azimuth is to the right, the variation is East.




| | ° | ′ | ″ | |
|---|---|---|---|---|
| True Alt. .. .. | 47 | 15 | 1·6 | Secant 0·168263 |
| Lat. .. .. .. | 51 | 4 | 24 | Secant 0·201816 |
| N. P. D. .. .. | 70 | 19 | 00·9 | |
| 2) | 168 | 38 | 26·5 | |
| ½ Sum .. .. = | 84 | 19 | 13·2 | Cosine 8·995491 |
| ½ Sum ∼ N.P.D. | 14 | 00 | 12·3 | Cosine 9·986898 |

9·352468 = Log. Sin. Square = S. 56° 39′ E. ☉'s True Azimuth.
S. 41 21 E. ☉'s Magnetic Bearing.

Error of Compass = 15 18 W.

* When the bearing is taken with a prismatic compass, and is less than 90°, it is counted from N. towards E., as N. 70° E.; when it is greater than 90° and less than 180°, subtract the bearing from 180°, and it is counted from S. towards E., thus, 160° would be S. 20 E°.; when it is greater than 180° and less than 270°, subtract 180° from the bearing, and it will be counted from S. towards W., thus, 200° is S. 20° W.; when it is greater than 270°, subtract the bearing from 360°, and it is counted from N. to W., thus 340° is N. 20° W.

## PART V.

# DETERMINATION OF HEIGHTS.

*By* FRANCIS GALTON, F.R.S.

*By the Temperature of Boiling Water.*

Enter Table I., p. 210, with the boiling-point at each of the two stations, and extract the numbers that stand opposite to them in the column headed "Altitude, &c." The difference between these numbers gives the difference of height between the two stations, supposing the mean temperature of the intermediate air to be 32° Fahr. The correction for the temperature of the air, when it differs from this value, is given in Table II. We take the mean * of the thermometers (exposed in shade) at the upper and lower stations, and we enter Table II. with that mean value, and the number that stands opposite to it, in the column headed "Multiplier," must be multiplied with the results obtained from Table I. Thus:—

At station A the boiling-point = 195°·1, tabular number = 9040
„ B „ = 210°·3, „ = 887

Approximate difference of height = 8153 feet.

To correct for temperature of intermediate air:—
At station A, temp. of air = 65° Fahr.
„ B, „ = 73° „

2 ) 138

69 = mean temperature of intermediate air.

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* This represents more nearly the average temperature of the intervening column of air than any other value that can easily be specified. But it is only an approximation of the truth.

In Table II. the multiplier corresponding to 69° is 1·082, and 1·082 × 8153 = 8821 (neglecting decimal fractions).

In those rare cases where greater altitudes are dealt with than are included within the limits of the table, the traveller should allow 570 feet for the difference between 185° and 184°; 572 feet for that between 184° and 183°; 574 feet for the next interval, and so on.

TABLE I.*

| Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. | Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. | Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. |
|---|---|---|---|---|---|---|---|---|
| 185·0 | 14698 | 17·048 | 186·7 | 13733 | 17·690 | 188·4 | 12772 | 18·353 |
| ·1 | 14641 | 17·085 | ·8 | 13676 | 17·729 | ·5 | 12716 | 18·393 |
| ·2 | 14584 | 17·122 | ·9 | 13620 | 17·767 | ·6 | 12660 | 18·432 |
| ·3 | 14528 | 17·160 | 187·0 | 13563 | 17·806 | ·7 | 12603 | 18·472 |
| ·4 | 14471 | 17·197 | ·1 | 13506 | 17·844 | ·8 | 12547 | 18·512 |
| ·5 | 14414 | 17·235 | ·2 | 13450 | 17·883 | ·9 | 12490 | 18·552 |
| ·6 | 14357 | 17·272 | ·3 | 13394 | 17·922 | 189·0 | 12434 | 18·592 |
| ·7 | 14300 | 17·310 | ·4 | 13337 | 17·961 | ·1 | 12377 | 18·632 |
| ·8 | 14244 | 17·348 | ·5 | 13281 | 18·000 | ·2 | 12321 | 18·672 |
| ·9 | 14187 | 17·385 | ·6 | 13224 | 18·039 | ·3 | 12265 | 18·712 |
| 186·0 | 14130 | 17·423 | ·7 | 13167 | 18·078 | ·4 | 12209 | 18·753 |
| ·1 | 14073 | 17·461 | ·8 | 13111 | 18·117 | ·5 | 12153 | 18·793 |
| ·2 | 14017 | 17·499 | ·9 | 13054 | 18·156 | ·6 | 12096 | 18·833 |
| ·3 | 13960 | 17·537 | 188·0 | 12998 | 18·195 | ·7 | 12040 | 18·874 |
| ·4 | 13903 | 17·575 | ·1 | 12942 | 18·235 | ·8 | 11984 | 18·914 |
| ·5 | 13857 | 17·614 | ·2 | 12885 | 18·274 | ·9 | 11928 | 18·955 |
| ·6 | 13790 | 17·652 | ·3 | 12829 | 18·314 | 190·0 | 11872 | 18·996 |

* These extended Tables will give much facility to the traveller both in calculating altitudes, and in checking the index error of the aneroid, by means of the boiling-point thermometer. I have computed Table I. from Tables XXVI. and II., in the hypsometric series in Guyot's collection. It did not seem worth while to correct the figures thence obtained for the slight excess of temperature, viz.: 0°·015 Fahr. of the French boiling-point over that of the English. It is too small to be sensible in ordinary instruments, and it becomes totally unimportant in determining *differences* of level, or *changes* in the index error of an aneroid.—F. GALTON.

TABLE I.—*continued.*

| Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. | Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. | Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. |
|---|---|---|---|---|---|---|---|---|
| 190·1 | 11816 | 19·036 | 194·5 | 9371 | 20·905 | 198·9 | 6962 | 22·924 |
| ·2 | 11760 | 19·077 | ·6 | 9315 | 20·949 | 199·0 | 6908 | 22·971 |
| ·3 | 11704 | 19·118 | ·7 | 9260 | 20·993 | ·1 | 6854 | 23·019 |
| ·4 | 11648 | 19·159 | ·8 | 9205 | 21·038 | ·2 | 6800 | 23·067 |
| ·5 | 11592 | 19·200 | ·9 | 9150 | 21·082 | ·3 | 6745 | 23·115 |
| ·6 | 11536 | 19·241 | 195·0 | 9095 | 21·126 | ·4 | 6691 | 23·163 |
| ·7 | 11480 | 19·283 | ·1 | 9040 | 21·171 | ·5 | 6637 | 23·211 |
| ·8 | 11424 | 19·324 | ·2 | 8985 | 21·216 | ·6 | 6583 | 23·259 |
| ·9 | 11368 | 19·365 | ·3 | 8930 | 21·260 | ·7 | 6529 | 23·308 |
| 191·0 | 11312 | 19·407 | ·4 | 8875 | 21·305 | ·8 | 6474 | 23·356 |
| ·1 | 11257 | 19·448 | ·5 | 8820 | 21·350 | ·9 | 6420 | 23·405 |
| ·2 | 11201 | 19·490 | ·6 | 8765 | 21·395 | 200·0 | 6366 | 23·453 |
| ·3 | 11146 | 19·532 | ·7 | 8710 | 21·440 | ·1 | 6312 | 23·502 |
| ·4 | 11090 | 19·573 | ·8 | 8655 | 21·485 | ·2 | 6258 | 23·550 |
| ·5 | 11034 | 19·615 | ·9 | 8600 | 21·530 | ·3 | 6203 | 23·599 |
| ·6 | 10978 | 19·657 | 196·0 | 8545 | 21·576 | ·4 | 6149 | 23·648 |
| ·7 | 10922 | 19·699 | ·1 | 8490 | 21·621 | ·5 | 6095 | 23·697 |
| ·8 | 10867 | 19·741 | ·2 | 8435 | 21·666 | ·6 | 6041 | 23·746 |
| ·9 | 10811 | 19·783 | ·3 | 8381 | 21·712 | ·7 | 5987 | 23·795 |
| 192·0 | 10755 | 19·825 | ·4 | 8326 | 21·751 | ·8 | 5933 | 23·845 |
| ·1 | 10699 | 19·868 | ·5 | 8271 | 21·803 | ·9 | 5879 | 23·894 |
| ·2 | 10644 | 19·910 | ·6 | 8216 | 21·849 | 201·0 | 5825 | 23·943 |
| ·3 | 10588 | 19·952 | ·7 | 8161 | 21·895 | ·1 | 5771 | 23·993 |
| ·4 | 10533 | 19·995 | ·8 | 8107 | 21·941 | ·2 | 5717 | 24·042 |
| ·5 | 10477 | 20·037 | ·9 | 8052 | 21·987 | ·3 | 5663 | 24·092 |
| ·6 | 10422 | 20·080 | 197·0 | 7997 | 22·033 | ·4 | 5609 | 24·142 |
| ·7 | 10366 | 20·123 | ·1 | 7942 | 22·079 | ·5 | 5556 | 24·191 |
| ·8 | 10310 | 20·166 | ·2 | 7888 | 22·125 | ·6 | 5502 | 24·241 |
| ·9 | 10255 | 20·208 | ·3 | 7833 | 22·172 | ·7 | 5448 | 24·291 |
| 193·0 | 10199 | 20·251 | ·4 | 7779 | 22·218 | ·8 | 5394 | 24·341 |
| ·1 | 10144 | 20·294 | ·5 | 7724 | 22·264 | ·9 | 5340 | 24·391 |
| ·2 | 10088 | 20·338 | ·6 | 7669 | 22·311 | 202·0 | 5286 | 24·442 |
| ·3 | 10033 | 20·381 | ·7 | 7615 | 22·358 | ·1 | 5232 | 24·492 |
| ·4 | 9978 | 20·424 | ·8 | 7560 | 22·404 | ·2 | 5178 | 24·542 |
| ·5 | 9923 | 20·467 | ·9 | 7506 | 22·451 | ·3 | 5124 | 24·593 |
| ·6 | 9867 | 20·511 | 198·0 | 7451 | 22·498 | ·4 | 5070 | 24·644 |
| ·7 | 9812 | 20·554 | ·1 | 7397 | 22·545 | ·5 | 5017 | 24·694 |
| ·8 | 9757 | 20·598 | ·2 | 7343 | 22·592 | ·6 | 4964 | 24·745 |
| ·9 | 9701 | 20·641 | ·3 | 7289 | 22·639 | ·7 | 4910 | 24·796 |
| 194·0 | 9646 | 20·685 | ·4 | 7234 | 22·686 | ·8 | 4856 | 24·847 |
| ·1 | 9591 | 20·729 | ·5 | 7180 | 22·734 | ·9 | 4802 | 24·898 |
| ·2 | 9536 | 20·773 | ·6 | 7125 | 22·781 | 203·0 | 4749 | 24·949 |
| ·3 | 9481 | 20·817 | ·7 | 7071 | 22·829 | ·1 | 4695 | 25·000 |
| ·4 | 9426 | 20·861 | ·8 | 7016 | 22·876 | ·2 | 4641 | 25·051 |

TABLE I.—*continued.*

| Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. | Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. | Boiling point Fahr. | Altitude above level at which water boils at 212° (temp. of intermediate air being 32° F.). | Approximate corresponding height of aneroid or barometer. |
|---|---|---|---|---|---|---|---|---|
| 203·3 | 4588 | 25·103 | 207·2 | 2516 | 27·179 | 211·1 | 469 | 29·390 |
| ·4 | 4535 | 25·154 | ·3 | 2464 | 27·231 | ·2 | 417 | 29·449 |
| ·5 | 4482 | 25·206 | ·4 | 2411 | 27·286 | ·3 | 365 | 29·508 |
| ·6 | 4428 | 25·257 | ·5 | 2358 | 27·341 | ·4 | 313 | 29·566 |
| ·7 | 4375 | 25·309 | ·6 | 2305 | 27·397 | ·5 | 261 | 29·625 |
| ·8 | 4322 | 25·361 | ·7 | 2252 | 27·452 | ·6 | 208 | 29·684 |
| ·9 | 4268 | 25·413 | ·8 | 2199 | 27·507 | ·7 | 156 | 29·744 |
| 204·0 | 4215 | 25·465 | ·9 | 2146 | 27·563 | ·8 | 104 | 29·803 |
| ·1 | 4161 | 25·517 | 208·0 | 2094 | 27·618 | ·9 | 52 | 29·862 |
| ·2 | 4107 | 25·569 | ·1 | 2041 | 27·674 | 212·0 | 0 | 29·922 |
| ·3 | 4053 | 25·621 | ·2 | 1989 | 27·730 | ·1 | — 52 | 29·981 |
| ·4 | 4000 | 25·674 | ·3 | 1936 | 27·786 | ·2 | — 104 | 30·041 |
| ·5 | 3947 | 25·726 | ·4 | 1884 | 27·842 | ·3 | — 155 | 30·101 |
| ·6 | 3894 | 25·779 | ·5 | 1831 | 27·898 | ·4 | — 207 | 30·161 |
| ·7 | 3841 | 25·831 | ·6 | 1778 | 27·954 | ·5 | — 259 | 30·221 |
| ·8 | 3788 | 25·884 | ·7 | 1726 | 28·011 | ·6 | — 311 | 30·281 |
| ·9 | 3735 | 25·937 | ·8 | 1673 | 28·067 | ·7 | — 363 | 30·341 |
| 205·0 | 3682 | 25·990 | ·9 | 1621 | 28·123 | ·8 | — 414 | 30·401 |
| ·1 | 3625 | 26·043 | 209·0 | 1568 | 28·180 | ·9 | — 466 | 30·461 |
| ·2 | 3574 | 26·096 | ·1 | 1516 | 28·237 | 213·0 | — 518 | 30·522 |
| ·3 | 3521 | 26·149 | ·2 | 1463 | 28·293 | ·1 | — 570 | 30·583 |
| ·4 | 3468 | 26·202 | ·3 | 1411 | 28·350 | ·2 | — 621 | 30·644 |
| ·5 | 3416 | 26·255 | ·4 | 1358 | 28·407 | ·3 | — 673 | 30·705 |
| ·6 | 3363 | 26·309 | ·5 | 1306 | 28·464 | ·4 | — 724 | 30·766 |
| ·7 | 3310 | 26·362 | ·6 | 1254 | 28·521 | ·5 | — 776 | 30·827 |
| ·8 | 3256 | 26·416 | ·7 | 1201 | 28·579 | ·6 | — 828 | 30·888 |
| ·9 | 3203 | 26·470 | ·8 | 1149 | 28·636 | ·7 | — 880 | 30·949 |
| 206·0 | 3151 | 26·523 | ·9 | 1096 | 28·693 | ·8 | — 932 | 31·010 |
| ·1 | 3098 | 26·577 | 210·0 | 1044 | 28·751 | ·9 | — 983 | 31·071 |
| ·2 | 3045 | 26·631 | ·1 | 992 | 28·809 | 214·0 | —1035 | 31·132 |
| ·3 | 2992 | 26·685 | ·2 | 939 | 28·866 | ·1 | —1086 | 31·194 |
| ·4 | 2939 | 26·740 | ·3 | 887 | 28·924 | ·2 | —1138 | 31·256 |
| ·5 | 2886 | 26·794 | ·4 | 835 | 28·982 | ·3 | —1189 | 31·318 |
| ·6 | 2833 | 26·848 | ·5 | 783 | 29·040 | ·4 | —1241 | 31·380 |
| ·7 | 2780 | 26·903 | ·6 | 730 | 29·098 | ·5 | —1293 | 31·442 |
| ·8 | 2727 | 26·957 | ·7 | 678 | 29·156 | ·6 | —1344 | 31·504 |
| ·9 | 2674 | 27·012 | ·8 | 626 | 29·215 | ·7 | —1396 | 31·566 |
| 207·0 | 2622 | 27·066 | ·9 | 573 | 29·273 | ·8 | —1447 | 31·628 |
| ·1 | 2569 | 27·121 | 211·0 | 521 | 29·331 | ·9 | —1549 | 31·690 |

TABLE II.—CORRECTION FOR TEMPERATURE OF INTERMEDIATE AIR.

| Mean temperature of intermediate air. | Multiplier. | Mean temperature of intermediate air. | Multiplier. | Mean temperature of intermediate air. | Multiplier. | Mean temperature of intermediate air. | Multiplier. |
|---|---|---|---|---|---|---|---|
| ° | | ° | | ° | | ° | |
| 20 | 0·9734 | 37 | 1·0111 | 54 | 1·0488 | 70 | 1·0844 |
| 21 | 0·9756 | 38 | 1·0133 | 55 | 1·0511 | 71 | 1·0866 |
| 22 | 0·9778 | 39 | 1·0155 | 56 | 1·0533 | 72 | 1·0888 |
| 23 | 0·9801 | 40 | 1·0177 | 57 | 1·0555 | 73 | 1·0911 |
| 24 | 0·9823 | 41 | 1·0199 | 58 | 1·0577 | 74 | 1·0933 |
| 25 | 0·9845 | 42 | 1·0222 | 59 | 1·0599 | 75 | 1·0955 |
| 26 | 0·9867 | 43 | 1·0244 | 60 | 1·0622 | 76 | 1·0977 |
| 27 | 0·9889 | 44 | 1·0266 | 61 | 1·0644 | 77 | 1·0999 |
| 28 | 0·9912 | 45 | 1·0288 | 62 | 1·0666 | 78 | 1·1022 |
| 29 | 0·9934 | 46 | 1·0311 | 63 | 1·0688 | 79 | 1·1044 |
| 30 | 0·9956 | 47 | 1·0333 | 64 | 1·0711 | 80 | 1·1066 |
| 31 | 0·9978 | 48 | 1·0355 | 65 | 1·0733 | 81 | 1·1088 |
| 32 | 1·0000 | 49 | 1·0377 | 66 | 1·0755 | 82 | 1·1111 |
| 33 | 1·0022 | 50 | 1·0399 | 67 | 1·0777 | 83 | 1·1133 |
| 34 | 1·0044 | 51 | 1·0422 | 68 | 1·0799 | 84 | 1·1156 |
| 35 | 1·0066 | 52 | 1·0444 | 69 | 1·0822 | 85 | 1·1178 |
| 36 | 1·0088 | 53 | 1·0466 | | | | |

When the boiling point at the upper station alone is observed by the traveller, he sometimes has the opportunity of availing himself of some established observatory at no great distance, to serve as the lower station. A memoir by R. Scott, F.R.S., late Secretary to the Meteorological Office, published with a map in Vol. XI. of the 'Journ. Roy. Meteor. Soc.,' shows the distribution of stations past and present, over the globe. But these are continually changing, so the intending traveller should seek the latest information at the Meteorological Office, 63, Victoria Street, S.W.

Usually, however, the traveller has no option but to take the mean height of the barometer, reduced to the sea-level, in the district in which he is, and for the same season of the year, and to use this in the place of observations at a lower station. He will find what he wants in the maps of mean barometric pressure, reduced to sea-level, that are given in most of the physical atlases ('Bartholomew's Physical Atlas,' Vol. III., is the most recent of these), and also in 'Report on the Scientific Results of the Voyage of the Challenger, during the years 1873–76.' 'Physics and Chemistry,' Vol. II. (The section of this volume on

Atmospheric Circulation, by A. Buchan, M.A., LL.D., contains valuable statistical information on thermometric and barometric observations in different parts of the world, and a series of charts of the world showing isothermal and isobaric lines for every month of the year.) The charts published by the Meteorological Office refer to the ocean only, but they have the advantage of being quarterly, and are therefore preferable whenever the traveller's station is near the coast. It seems impossible to compress the information given by these charts into a form suitable to these pages, especially as the mean barometric height sometimes varies greatly in neighbouring places. The distance from Takutsk in Siberia to the Sea of Okhotsk is only 500 miles, yet in winter the calculated mean heights of the barometer at these two places, when reduced to sea-level, differ as much as 0·8 inch. From the latitude of Valdivia in S. America to Cape Horn, the distance is 900 miles, and the mean difference of barometric pressure is 0·5 inch. Vancouver's Island is another district where the mean barometer differs much at moderate distances.

Whenever the observations at the upper and lower stations are not strictly simultaneous, or when the mean barometer is taken in place of the lower station, the correction for diurnal variation must not be omitted, especially in the tropics, where, in other respects, the barometer is very steady. The mean amount of diurnal variation in different parts of the world is also given in Berghaus' maps. An error of one or two hundred feet might often be caused by the neglect to allow for it.

The traveller cannot be too strongly urged to have his boiling-point thermometer verified both before starting and after returning. Their index error is apt to vary, the thermometer reading lower than it should do after frequent use. This is especially the case for the first few years after they are made.

*By Barometer or Aneroid.*

The small but complete tables (pp. 217, 218) will be especially useful to those who carry a mountain barometer and are anxious to make accurate determinations, but are not furnished with larger tables. These are calculated by Loomis, and are extracted from Guyot's collection.

Part I. gives the altitude, subject to correction, for the temperature of the air, and for the other influences which are the subjects of Parts II., III., IV., and V.

*Method of Computation.*—(1) Take from Part I. the two numbers corresponding to the two barometric heights; (2) from their difference subtract the correction found in Part II., with the difference between the thermometers that are attached to the barometers (*Mem.*: this correction is not wanted for aneroids, for their works are mechanically compensated for temperature); (3) for the temperature of the intermediate air between the two stations, multiply the nine-hundredth part of the value already obtained by the difference between the sum of the temperatures at the two stations and 64°. This correction is additive when the sum of the temperatures exceeds 64°, otherwise it is subtractive; or, what comes to the same thing, use the multiplier already given in Table II., p. 213. (4) For further precision take corrections from Parts III. and IV., also from Part V., when the lower station is so high as to bring the case within the range of that table:—

| (*Example* 1.) | Upper Station. ° | Lower Station by Sea. ° |
|---|---|---|
| Thermometer in open air | 70·3 | 77·5 |
| Thermometer in barometer | 70·3 | 77·5 |
| | Inches. | Inches. |
| Barometer | 23·66 | 30·046 |
| Latitude 21°. | | |
| Part I. gives for 30·046 inches | | 27649·7 |
| Part I. gives for 23·66 inches | | 21406·9 |
| Difference | | 6242·8 |
| Part II. gives for 77°·5 − 70°·3 (= 7°·2) | | −16·9 |
| Approximate altitude | | 6225·9 |
| $\frac{6225·9}{900} \times (77°·5 + 70°·3 - 64°) = 6·918 \times 83·8$ | = | +579·7* |
| Nearly correct altitude | | 6805·6 |
| Part III. gives for above altitude and latitude 21° | | +13·3 |
| Part IV. gives for above altitude | | +19·3 |
| Part V. is not used in this case | | 0·0 |
| Correct height above sea | | 6838·2 feet. |

* If Table II., p. 213, had been used, we should have written—

$$\frac{77°·5 + 70°·3}{2} = 74° \text{ nearly.}$$

The corresponding multiplier is 1·0933

$$1·0933 \times 6225·9 = 6806·8.$$

(*Example* 2.)
The Lower Station is in Lat. 30°, 4890 ft. above sea-level.

| | Upper Station. | | Lower Station. |
|---|---|---|---|
| | ° | | ° |
| Thermometer in open air .. .. .. .. .. | 32 | .. | 89 |
| Thermometer in barometer.. .. .. .. .. | 35 | .. | 89 |
| | Inches. | | Inches. |
| Barometer .. .. .. .. .. .. .. | 15·76 | .. | 25·07 |
| Part I. gives { for 25·07 inches .. .. .. .. | .. .. | .. | 22919·3 |
| Part I. gives { for 15·76 inches .. .. .. .. | .. .. | .. | 10791·3 |
| Difference .. .. | .. .. | .. | 12128 |
| Part II. gives for 89° − 35° .. .. .. .. | .. .. | .. | −126 |
| Approximate altitude | .. .. | .. | 12001 |
| $\frac{12001 \cdot 6}{900} \times (89° + 32° - 64°) = 13 \cdot 3 \times 57$ .. .. | .. .. | = | +758 |
| Nearly correct altitude | .. .. | .. | 12759 |
| Height of Lower Station | .. .. | .. | 4890 |
| | | | 17649 |
| From Part III. .. .. .. .. .. .. | .. .. | .. | +22 |
| From Part IV. .. .. .. .. .. .. | .. .. | .. | +56 |
| From Part V. .. .. .. .. .. .. | .. .. | .. | +7 |
| Altitude above the sea-level .. .. .. .. | .. .. | .. | 17734 |

For high elevations it is needless to pay attention to decimals.

## PART I.

ARGUMENT, THE OBSERVED HEIGHT OF THE BAROMETER AT EITHER STATION.

| Inches. | Feet. | Diff. | Inches. | Feet. | Diff. | Inches. | Feet. | Diff. | Inches. | Feet. | Diff. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11·0 | 1396·9 | 236·4 | 16·0 | 11186·3 | 162·8 | 21·0 | 18291·0 | 124·1 | 26·0 | 23871·0 | 100·3 |
| 11·1 | 1633·3 | 234·3 | 16·1 | 11349·1 | 161·8 | 21·1 | 18415·1 | 123·6 | 26·1 | 23971·3 | 99·9 |
| 11·2 | 1867·6 | 232·3 | 16·2 | 11510·9 | 160·8 | 21·2 | 18538·7 | 122·9 | 26·2 | 24071·2 | 99·5 |
| 11·3 | 2099·9 | 230·2 | 16·3 | 11671·7 | 159·8 | 21·3 | 18661·6 | 122·4 | 26·3 | 24170·7 | 99·1 |
| 11·4 | 2330·1 | 228·2 | 16·4 | 11831·5 | 158·8 | 21·4 | 18784·0 | 121·8 | 26·4 | 24269·8 | 98·8 |
| 11·5 | 2558·3 | 226·2 | 16·5 | 11990·3 | 157·9 | 21·5 | 18905·8 | 121·2 | 26·5 | 24368·6 | 98·4 |
| 11·6 | 2784·5 | 224·2 | 16·6 | 12148·2 | 156·9 | 21·6 | 19027·0 | 120·7 | 26·6 | 24467·0 | 98·1 |
| 11·7 | 3008·7 | 222·4 | 16·7 | 12305·1 | 155·9 | 21·7 | 19147·7 | 120·1 | 26·7 | 24565·1 | 97·6 |
| 11·8 | 3231·1 | 220·5 | 16·8 | 12461·0 | 155·1 | 21·8 | 19267·8 | 119·6 | 26·8 | 24662·7 | 97·3 |
| 11·9 | 3451·6 | 218·6 | 16·9 | 12616·1 | 154·1 | 21·9 | 19387·4 | 119·0 | 26·9 | 24760·0 | 97·0 |
| 12·0 | 3670·2 | 216·8 | 17·0 | 12770·2 | 153·3 | 22·0 | 19506·4 | 118·5 | 27·0 | 24857·0 | 96·6 |
| 12·1 | 3887·0 | 215·0 | 17·1 | 12923·5 | 152·3 | 22·1 | 19624·9 | 118·0 | 27·1 | 24953·6 | 96·2 |
| 12·2 | 4102·0 | 213·3 | 17·2 | 13075·8 | 151·5 | 22·2 | 19742·9 | 117·4 | 27·2 | 25049·8 | 95·9 |
| 12·3 | 4315·3 | 211·6 | 17·3 | 13227·3 | 150·6 | 22·3 | 19860·3 | 116·9 | 27·3 | 25145·7 | 95·5 |
| 12·4 | 4526·9 | 209·8 | 17·4 | 13377·9 | 149·7 | 22·4 | 19977·2 | 116·4 | 27·4 | 25241·2 | 95·2 |
| 12·5 | 4736·7 | 208·2 | 17·5 | 13527·6 | 148·9 | 22·5 | 20093·6 | 115·8 | 27·5 | 25336·4 | 94·8 |
| 12·6 | 4944·9 | 206·5 | 17·6 | 13676·5 | 148·0 | 22·6 | 20209·4 | 115·4 | 27·6 | 25431·2 | 94·5 |
| 12·7 | 5151·4 | 205·0 | 17·7 | 13824·5 | 147·2 | 22·7 | 20324·8 | 114·8 | 27·7 | 25525·7 | 94·2 |
| 12·8 | 5356·4 | 203·3 | 17·8 | 13971·7 | 146·3 | 22·8 | 20439·6 | 114·4 | 27·8 | 25619·9 | 93·8 |
| 12·9 | 5559·7 | 201·7 | 17·9 | 14118·0 | 145·6 | 22·9 | 20554·0 | 113·8 | 27·9 | 25713·7 | 93·4 |
| 13·0 | 5761·4 | 200·2 | 18·0 | 14263·6 | 144·7 | 23·0 | 20667·8 | 113·3 | 28·0 | 25807·1 | 93·2 |
| 13·1 | 5961·6 | 198·7 | 18·1 | 14408·3 | 144·0 | 23·1 | 20781·1 | 112·9 | 28·1 | 25900·3 | 92·8 |
| 13·2 | 6160·3 | 197·2 | 18·2 | 14552·3 | 143·1 | 23·2 | 20894·0 | 112·4 | 28·2 | 25993·1 | 92·5 |
| 13·3 | 6357·5 | 195·7 | 18·3 | 14695·4 | 142·4 | 23·3 | 21006·4 | 111·9 | 28·3 | 26085·6 | 92·1 |
| 13·4 | 6553·2 | 194·3 | 18·4 | 14837·8 | 141·6 | 23·4 | 21118·3 | 111·4 | 28·4 | 26177·7 | 91·9 |
| 13·5 | 6747·5 | 192·8 | 18·5 | 14979·4 | 140·9 | 23·5 | 21229·7 | 110·9 | 28·5 | 26269·6 | 91·5 |
| 13·6 | 6940·3 | 191·4 | 18·6 | 15120·3 | 140·0 | 23·6 | 21340·6 | 110·5 | 28·6 | 26361·1 | 91·2 |
| 13·7 | 7131·7 | 190·0 | 18·7 | 15260·3 | 139·4 | 23·7 | 21451·1 | 110·0 | 28·7 | 26452·3 | 90·9 |
| 13·8 | 7321·7 | 188·6 | 18·8 | 15399·7 | 138·6 | 23·8 | 21561·1 | 109·5 | 28·8 | 26543·2 | 90·5 |
| 13·9 | 7510·3 | 187·3 | 18·9 | 15538·3 | 137·9 | 23·9 | 21670·6 | 109·1 | 28·9 | 26633·7 | 90·3 |
| 14·0 | 7697·6 | 186·0 | 19·0 | 15676·2 | 137·1 | 24·0 | 21779·7 | 108·7 | 29·0 | 26724·0 | 89·9 |
| 14·1 | 7883·6 | 184·6 | 19·1 | 15813·3 | 136·5 | 24·1 | 21888·4 | 108·2 | 29·1 | 26813·9 | 89·6 |
| 14·2 | 8068·2 | 183·3 | 19·2 | 15949·8 | 135·7 | 24·2 | 21996·6 | 107·7 | 29·2 | 26903·5 | 89·3 |
| 14·3 | 8251·5 | 182·1 | 19·3 | 16085·5 | 135·0 | 24·3 | 22104·3 | 107·3 | 29·3 | 26992·8 | 89·1 |
| 14·4 | 8433·6 | 180·8 | 19·4 | 16220·5 | 134·3 | 24·4 | 22211·6 | 106·8 | 29·4 | 27081·9 | 88·7 |
| 14·5 | 8614·4 | 179·6 | 19·5 | 16354·8 | 133·7 | 24·5 | 22318·4 | 106·4 | 29·5 | 27170·6 | 88·4 |
| 14·6 | 8794·0 | 178·3 | 19·6 | 16488·5 | 132·9 | 24·6 | 22424·8 | 106·0 | 29·6 | 27259·0 | 88·1 |
| 14·7 | 8972·3 | 177·2 | 19·7 | 16621·4 | 132·3 | 24·7 | 22530·8 | 105·6 | 29·7 | 27347·1 | 87·8 |
| 14·8 | 9149·5 | 176·0 | 19·8 | 16753·7 | 131·6 | 24·8 | 22636·4 | 105·1 | 29·8 | 27434·9 | 87·6 |
| 14·9 | 9325·5 | 174·8 | 19·9 | 16885·3 | 131·0 | 24·9 | 22741·5 | 104·8 | 29·9 | 27522·5 | 87·2 |
| 15·0 | 9500·3 | 173·5 | 20·0 | 17016·3 | 130·3 | 25·0 | 22846·3 | 104·3 | 30·0 | 27609·7 | 86·9 |
| 15·1 | 9673·8 | 172·4 | 20·1 | 17146·6 | 129·7 | 25·1 | 22950·6 | 103·8 | 30·1 | 27696·6 | 86·7 |
| 15·2 | 9846·2 | 171·3 | 20·2 | 17276·3 | 129·0 | 25·2 | 23054·4 | 103·5 | 30·2 | 27783·3 | 86·4 |
| 15·3 | 10017·5 | 170·2 | 20·3 | 17405·3 | 128·4 | 25·3 | 23157·9 | 103·1 | 30·3 | 27869·7 | 86·0 |
| 15·4 | 10187·7 | 169·1 | 20·4 | 17533·7 | 127·7 | 25·4 | 23261·0 | 102·6 | 30·4 | 27955·7 | 85·8 |
| 15·5 | 10356·8 | 168·0 | 20·5 | 17661·4 | 127·2 | 25·5 | 23363·6 | 102·3 | 30·5 | 28041·5 | 85·6 |
| 15·6 | 10524·8 | 167·0 | 20·6 | 17788·6 | 126·5 | 25·6 | 23465·9 | 101·8 | 30·6 | 28127·1 | 85·2 |
| 15·7 | 10691·8 | 165·9 | 20·7 | 17915·1 | 125·9 | 25·7 | 23567·7 | 101·5 | 30·7 | 28212·3 | 85·0 |
| 15·8 | 10857·7 | 164·8 | 20·8 | 18041·0 | 125·3 | 25·8 | 23669·2 | 101·1 | 30·8 | 28297·3 | 84·7 |
| 15·9 | 11022·5 | 163·8 | 20·9 | 18166·3 | 124·7 | 25·9 | 23770·3 | 100·7 | 30·9 | 28382·0 | 84·4 |
| 16·0 | 11186·3 | | 21·0 | 18291·0 | | 26·0 | 23871·0 | | 31·0 | 28466·4 | |

## PART II.

CORRECTION DUE TO T—T′, OR THE DIFFERENCE OF THE TEMPERATURES OF THE BAROMETERS THEMSELVES (NOT FOR THAT OF THE INTERMEDIATE AIR) AT THE TWO STATIONS.

*This Correction is Negative when the Temperature at the upper station is lowest, and vice versâ.*

| T—T′. | Correction. | T—T′. | Correction. | T—T′. | Correction. | T—T′. | Correction. | T—T′. | Correction. | T—T′. | Correction. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fahr. | Feet. | Fahr. | Feet. | Fahr. | Feet. | Fahr. | Feet. | Fahr. | Feet. | Fahr. | Feet. |
| 1° | 2·3 | 14° | 32·8 | 27° | 63·2 | 40° | 93·6 | 53° | 124·1 | 66° | 154·5 |
| 2 | 4·7 | 15 | 35·1 | 28 | 65·5 | 41 | 96·0 | 54 | 126·4 | 67 | 156·8 |
| 3 | 7·0 | 16 | 37·5 | 29 | 67·9 | 42 | 98·3 | 55 | 128·7 | 68 | 159·2 |
| 4 | 9·4 | 17 | 39·8 | 30 | 70·2 | 43 | 100·7 | 56 | 131·1 | 69 | 161·5 |
| 5 | 11·7 | 18 | 42·1 | 31 | 72·6 | 44 | 103·0 | 57 | 133·4 | 70 | 163·9 |
| 6 | 14·0 | 19 | 44·5 | 32 | 74·9 | 45 | 105·3 | 58 | 135·8 | 71 | 166·2 |
| 7 | 16·4 | 20 | 46·8 | 33 | 77·3 | 46 | 107·7 | 59 | 138·1 | 72 | 168·6 |
| 8 | 18·7 | 21 | 49·2 | 34 | 79·6 | 47 | 110·0 | 60 | 140·4 | 73 | 170·9 |
| 9 | 21·1 | 22 | 51·5 | 35 | 81·9 | 48 | 112·4 | 61 | 142·8 | 74 | 173·3 |
| 10 | 23·4 | 23 | 53·8 | 36 | 84·3 | 49 | 114·7 | 62 | 145·1 | 75 | 175·6 |
| 11 | 25·8 | 24 | 56·2 | 37 | 86·6 | 50 | 117·0 | 63 | 147·5 | 76 | 177·9 |
| 12 | 28·1 | 25 | 58·5 | 38 | 89·0 | 51 | 119·4 | 64 | 149·8 | 77 | 180·3 |
| 13 | 30·4 | 26 | 60·9 | 39 | 91·3 | 52 | 121·7 | 65 | 152·2 | 78 | 182·6 |

## PART III.

CORRECTION DUE TO THE CHANGE OF GRAVITY FROM THE LATITUDE OF 45° TO THE LATITUDE OF THE PLACE OF OBSERVATION.

*Positive from Lat. 0° to 45°; Negative from Lat. 45° to 90°.*

## PART IV.

CORRECTION FOR DECREASE OF GRAVITY ON A VERTICAL.

*Always Positive.*

## PART V.

CORRECTION DUE TO THE HEIGHT OF THE LOWER STATION.

*Always Positive.*

| App. Alt. | Latitude. 0° / 90° | 10° / 80° | 20° / 70° | 30° / 60° | 40° / 50° | 45° | Part IV. Always Positive. | Height of Barometer at Lower Station. 16 in. | 18 in. | 20 in. | 22 in. | 24 in. | 26 in. | 28 in. | App. Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. | Feet. |
| 1000 | 2·6 | 2·5 | 2·0 | 1·3 | 0·5 | 0 | 2·5 | 1·6 | 1·3 | 1·0 | 0·8 | 0·6 | 0·4 | 0·2 | 1000 |
| 2000 | 5·3 | 5·0 | 4·1 | 2·6 | 0·9 | 0 | 5·2 | 3·1 | 2·5 | 2·0 | 1·5 | 1·1 | 0·7 | 0·3 | 2000 |
| 3000 | 7·9 | 7·5 | 6·1 | 4·0 | 1·4 | 0 | 7·9 | 4·7 | 3·8 | 3·0 | 2·3 | 1·7 | 1·1 | 0·5 | 3000 |
| 4000 | 10·6 | 10·0 | 8·1 | 5·3 | 1·8 | 0 | 10·8 | 6·3 | 5·1 | 4·0 | 3·1 | 2·2 | 1·4 | 0·7 | 4000 |
| 5000 | 13·2 | 12·4 | 10·1 | 6·6 | 2·3 | 0 | 13·7 | 7·8 | 6·4 | 5·0 | 3·8 | 2·8 | 1·8 | 0·8 | 5000 |
| 6000 | 15·9 | 14·9 | 12·2 | 7·9 | 2·8 | 0 | 16·7 | 9·4 | 7·6 | 6·0 | 4·6 | 3·3 | 2·1 | 1·0 | 6000 |
| 7000 | 18·5 | 17·4 | 14·2 | 9·3 | 3·2 | 0 | 19·9 | 11·0 | 8·9 | 7·1 | 5·4 | 3·9 | 2·5 | 1·2 | 7000 |
| 8000 | 21·2 | 19·9 | 16·2 | 10·6 | 3·7 | 0 | 23·1 | 12·5 | 10·2 | 8·1 | 6·2 | 4·4 | 2·8 | 1·3 | 8000 |
| 9000 | 23·8 | 22·4 | 18·3 | 11·9 | 4·1 | 0 | 26·4 | 14·1 | 11·4 | 9·1 | 6·9 | 5·0 | 3·2 | 1·5 | 9000 |
| 10000 | 26·5 | 24·9 | 20·3 | 13·2 | 4·6 | 0 | 29·8 | 15·7 | 12·7 | 10·1 | 7·7 | 5·5 | 3·5 | 1·7 | 10000 |
| 11000 | 29·1 | 27·4 | 22·3 | 14·6 | 5·1 | 0 | 33·3 | 17·2 | 14·0 | 11·1 | 8·5 | 6·1 | 3·9 | 1·8 | 11000 |
| 12000 | 31·8 | 29·9 | 24·4 | 15·9 | 5·5 | 0 | 36·9 | 18·8 | 15·3 | 12·1 | 9·2 | 6·6 | 4·2 | 2·0 | 12000 |
| 13000 | 34·4 | 32·4 | 26·4 | 17·2 | 6·0 | 0 | 40·6 | 20·4 | 16·5 | 13·1 | 10·0 | 7·2 | 4·6 | 2·2 | 13000 |
| 14000 | 37·1 | 34·9 | 28·4 | 18·5 | 6·4 | 0 | 44·4 | 21·9 | 17·8 | 14·1 | 10·8 | 7·7 | 4·9 | 2·3 | 14000 |
| 15000 | 39·7 | 37·3 | 30·4 | 19·9 | 6·9 | 0 | 48·3 | 23·5 | 19·1 | 15·1 | 11·5 | 8·3 | 5·3 | 2·5 | 15000 |
| 16000 | 42·4 | 39·8 | 32·5 | 21·2 | 7·4 | 0 | 52·3 | 25·1 | 20·3 | 16·1 | 12·3 | 8·8 | 5·6 | 2·7 | 16000 |
| 17000 | 45·0 | 42·3 | 34·5 | 22·5 | 7·8 | 0 | 56·4 | 26·6 | 21·6 | 17·1 | 13·1 | 9·4 | 6·0 | 2·8 | 17000 |
| 18000 | 47·7 | 44·8 | 36·5 | 23·8 | 8·3 | 0 | 60·5 | 28·2 | 22·9 | 18·1 | 13·8 | 9·9 | 6·3 | 3·0 | 18000 |
| 19000 | 50·3 | 47·3 | 38·6 | 25·2 | 8·7 | 0 | 64·8 | 29·8 | 24·1 | 19·2 | 14·6 | 10·5 | 6·7 | 3·2 | 19000 |
| 20000 | 53·0 | 49·8 | 40·6 | 26·5 | 9·2 | 0 | 69·2 | 31·3 | 25·4 | 20·2 | 15·4 | 11·0 | 7·0 | 3·3 | 20000 |
| 21000 | 55·6 | 52·3 | 42·6 | 27·8 | 9·7 | 0 | 73·6 | 32·9 | 26·7 | 21·2 | 16·1 | 11·6 | 7·4 | 3·5 | 21000 |
| 22000 | 58·3 | 54·8 | 44·7 | 29·1 | 10·1 | 0 | 78·2 | 34·5 | 28·0 | 22·2 | 16·9 | 12·1 | 7·7 | 3·7 | 22000 |
| 23000 | 60·9 | 57·3 | 46·7 | 30·5 | 10·6 | 0 | 82·9 | 36·0 | 29·2 | 23·2 | 17·7 | 12·7 | 8·1 | 3·8 | 23000 |
| 24000 | 63·6 | 59·8 | 48·7 | 31·8 | 11·0 | 0 | 87·6 | 37·6 | 30·5 | 24·2 | 18·5 | 13·2 | 8·4 | 4·0 | 24000 |
| 25000 | 66·2 | 62·2 | 50·7 | 33·1 | 11·5 | 0 | 92·5 | 39·1 | 31·8 | 25·2 | 19·2 | 13·8 | 8·8 | 4·1 | 25000 |

# PART VI.

## TABLES.

*Explanation of the Tables.*

Table I. contains the sun's declination, to the nearest minute, for the years 1899, 1900, 1901, and 1902; the declinations for the years 1903, 1904, 1905 and 1906 are almost equally correct, but as 1900, though divisible by 4, is not a leap-year the day must be advanced by one for 1903 as shown in the table, thus the declination for January 7th, 1899, corresponds, nearly, for that of January 8th, 1903. This remark also applies to the equation of time, Table II., and the right ascension of the sun, Table III.

Table II. contains the equation of time for 1899, 1900, 1901 and 1902, to the nearest second, and will serve very well for common purposes for the 4th or 8th years after. The error will be greatest from the latter end of May to the middle of July, to 2 secs. or 3 secs. in a period of four years. The words "add" or "sub." indicate the manner in which the equation is to be applied to *apparent time* to convert it into mean time. (*See note on the year* 1903 *in explanation of Table I.*)

Table III. contains the apparent, or actual, right ascension of the sun for the years 1899, 1900, 1901, 1902, to the nearest second, and will be very nearly correct for every succeeding fourth year; they may be farther corrected by adding 0·55 secs. for each year elapsed from the given year.

The sidereal time at mean noon may be found approximately by applying the equation of time (Table II.) to the sun's right ascension the *contrary* way to that directed; thus the sun's right ascension August 5th, 1899, is 9 h. 1 m. 6 secs., and the equation of time (Table II.) is 5 m. 48 secs. "add"; hence *subtracting* 5 m. 48 secs. from 9 h. 1 m. 6 secs. = 8 h. 55 m. 18 secs., the sidereal time required, nearly. (*See note on the year* 1903 *in explanation of Table I.*).

Table IV. contains the mean places of 50 stars of the first and second magnitudes for the 1st of January, 1901, with their annual variation in right ascension and declination.

Tables V. and VI.—Table V. contains the approximate times of the meridian passages of 50 of the principal stars for the 1st of the month. To find the time of passage on any other day, *subtract* the portion of time corresponding to the day of the month in Table VI. from the time in Table V. As the times given in these tables are *apparent*, they must be converted into *mean* time by applying the equation of time as directed in Table II. should the mean time of meridian passage be required. The result arrived at by the use of these tables is only approximate, but will seldom be as much as 2m. in error.

N.B.—The altitude of any star when passing the meridian may be found by adding together the complement of the latitude of the place of observation and the declination of the star, when they are of the same name, or taking their difference when of contrary names; the altitude to be reckoned from the south point of the horizon when the latitude is north, and the contrary when south; but when the sum exceeds 90° it is to be taken from 180°, and the altitude is to be reckoned from the north in north latitude, and the south in south latitude. When using the artificial horizon, the altitude to which the index of the sextant is to be set must, of course, be *double the altitude* found by this method.

Table VII. contains the refraction for the barometer at 30 inches, and Fahrenheit's thermometer at 50°. The two small tables at the side contain corrections when the barometer differs from 30 inches or the thermometer from 50°.

Table VIII. exhibits half the time that a celestial body continues above the horizon when the latitude and declination are the same name; or below it when they are contrary names, and affords the means for computing the rising and setting of the sun, moon and stars, and the length of the night or day.

*To find the time of the sun's rising or setting*, enter Table VIII. with the latitude and declination, and the tabular value will show the apparent time of the sun's setting when the latitude and declination are the same name, or of its rising when the latitude and declination are of contrary names, and this, subtracted from 12 hours, will give the apparent time of the sun's rising in the former case, and of its setting in the latter.

Double the time of rising will give the length of the night.

Double the time of setting will give the length of the day.

*Example.*—Required the (apparent) time of the sun's rising and setting,

and the length of the day and night in lat. 46° N., and the declination 18° N.

Tabular value answering to lat. 46° and decl. 18° is 7 h. 19 m. Hence in lat. 46° N., decl. 18° N., time of sunset is 7 h. 19 m., and that of sunrise 12 h. − 7 h. 19 m. = 4 h. 41 m.

The same is true for lat. 46° S., decl. 18° S.

Conversely, both for lat. 46° N., decl. 18° S., and for lat. 46° S., decl. 18° N., the time of sunrise is 7 h. 19 m., and that of sunset is 4 h. 41 m.

In the first pair of cases the length of the day is 7 h. 19 m. × 2 = 14 h. 38 m., and that of the night is 4 h. 41 m. × 2 = 9 h. 22 m.; and in the second pair, conversely, the length of the night is 14 h. 38 m., and that of the day 9 h. 22 m.

*Example.*—At what time (apparent) does the star *a Ophiuchi* rise and set on May 12th, in lat. 30 S.?

| | H. | M. |
|---|---|---|
| Star's R. A. .. .. .. .. .. .. .. .. .. | 17 | 29 |
| Sun's R. A. .. .. .. .. .. .. .. .. .. | 3 | 15 |
| Star's approximate meridian passage .. .. .. .. .. | 14 | 14 |
| Time answering in table to 30° S. lat., and star's declination 12° 39′ N. = 6 h. 30 m. which, subtracted from 12, gives 5 h. 30 m. .. .. .. | 5 | 30 |
| Remainder = time of star's rising .. .. .. .. .. | 8 | 44 |
| Sum = time of star's setting .. .. .. .. .. .. | 19 | 44 P.M. |
| or .. .. .. .. | 7 | 44 A.M. |

Table IX., giving the distance of the horizon as seen over water from different heights above it, will be found very useful both in checking exaggerated estimates of the width of lakes whose opposite shores are invisible, and also as a rude means of judging the distance of objects seen across water.

Table X. gives the values of $\frac{2 \sin^2 \text{half-hour angle}}{\sin 1''}$, and is used in finding the latitude by altitudes of the sun, or of stars when they are near the meridian.

Table XI. gives the number of geographical miles, or minutes of the equator, contained in a degree of longitude under each parallel of latitude on the supposition of the earth's spheroidal shape with a compression of $\frac{1}{304}$.

Table XII. is for converting statute into geographical miles.

Table XIII. is for converting geographical into statute miles.

Table XIV. contains a comparison of Fahrenheit, Réaumur, and Centigrade thermometer scales.

Table XV. contains a comparison of English and French barometer scales to hundredths of an inch.

Table XVI. contains a comparison of mètres and English feet.

Table XVII. contains a comparison of kilomètres and English statute miles.

Table XVIII. contains a comparison of Russian versts and English statute miles.

Table XIX. contains a comparison of kilogrammes and pounds, avoirdupois.

Table XX. contains foreign moneys, with equivalents in British currency.

Table XXI. contains the difference of latitude and departure for the course at each degree. It will also be found useful for the conversion of one measure of length into another, thus: at 61°, the dist. and dep. correspond to statute and geographical miles; at 77°, dist. and dep. correspond to English and Danish feet; at 68°, dist. and dep. correspond to Dutch and English feet; at 66°, dist. and dep. correspond to French mètres and English yards; at 70°, dist. and dep. correspond to toises and fathoms; at 25°, dist. and dep. correspond to English feet and arsheens; at 35°, dist. and dep. correspond to versts and geographical miles; at 66°, dist. and dep. correspond to brazas and fathoms, or to varas and yards. These tables can also be used in solving, approximately, cases of right-angled triangles, as also in verifying the results of questions of the kind when obtained by logarithms.

Table XXII. is used to facilitate finding the longitude by moon culminating stars; for the manner in which it is used, see p. 200.

Table XXIII.—This table contains the angles subtended by a 10 ft. rod, at distances from 50 to 1500 feet. The angles are given for every foot from 50 to 200 feet, for every two feet from 200 to 402 feet, and for

every yard from 402 to 1500 feet. To use the table, search column for the angle measured, and opposite to this will be found the distance in feet. In that part of the table, where the distances are only given for every second or third foot, intermediate distances can be found by interpolation.

Table XXIV. contains useful constants.

Table XXV. *Logarithms of Numbers.*—The Table contains the logs. of numbers from 1 to 9999, to six places, with differences and proportional parts.

The diff. D. is the mean of the diffs. between each log. and the succeeding one in the same line; and is near enough for most cases.

I. *Direct process*; to find the logarithm of a given number.

1. To find the logarithm to any number consisting of two or three figures. Look for the number at the side, and take out the log. against it. Thus, the log. of 717 is 855519.*

2. To find the logarithm of a number consisting of four figures. Look for the three first figures at the side, and the fourth at the top; thus, the log. of 7176 is 855882.

3. To find the logarithm of a number consisting of more than four figures. Find the log. of the first four figures; find the diff. D. in the lower part of the Table, in column D, and against it, under the 5th figure (or 6th, if required), are the parts, which add.

*Example* 1.—(*Five* figs.) Find the log. of 26574.

| | | |
|---|---|---|
| 2657 log. | 424392 | D. 164 |
| Against D. 164, under 4 | 66 | |
| Log. req. | 424458 | |

*Example* 2.—(*Six* figs.) Find the log. of 265748.

| | | |
|---|---|---|
| 2567 log. | 424392 | D. 164 |
| 4 (parts 66) | 66 | |
| † 8 (parts 131 ÷ 10) | 13 | |
| Log. req. | 424471 | |

The arithmetical complement of a logarithm (Ar-co-log) is found by taking the logarithm from 10·000000, thus the Ar-co-log of 2·564782 is 7·435218.

* This, however, is only part of the complete logarithm, as adapted for purposes of computation, and requires the index.

† Observe to set down the parts correctly, carrying those for the 6th figure one place to the right of the parts above them, as a mistake frequently occurs here.

II. *Inverse Process;* to find the number corresponding to a given log.

1. When the natural number is not required to consist of more than four figures, it is taken out at once.

*Example.*—Given the log. 645820, required the natural number.

The nearest log. in the Table is 645815; the figures at the side are 442, annexing to which that at the top, or 4, gives 4424, the NUMBER required.

To place the decimal point. Add 1 to the given index of the log., and mark off to the left this number of figures; these will be whole numbers; the rest, if any, will be decimals.

2. When the Number is to consist of *five* figures. Take out the next less log. to the one given, and note down the four figures of the corresponding number. Note the diff. D.

Subtract this next less log. from the given one, and look for the remainder among the parts standing against D, in the lower part of the Table; note the figure at the top under which the remainder is found, and add it to the four taken out.

3. When the Number is to consist of *six* figures, the more direct and accurate method is to take the diff. between the given log. and the next less in the Table, annex 2 ciphers, and divide by the diff. between the next less and the next greater; the quotient is the number of figures to be annexed to the natural number, answering to the *next less* log.

Place the decimal point as previously directed.

*Example* 1. (*Five* figs.) Find the No. to the log. 424471.

| | | |
|---|---|---|
| Given .. .. .. .. .. .. .. .. .. | 424471 | |
| Next less (2657) .. .. .. .. .. .. .. | 424392 | D. 164 |
| Rem. .. .. .. .. .. .. .. .. .. | 79 | |
| 5th fig. 4, next less .. .. .. .. .. .. | 66 | |
| NUMB. req. .. .. .. .. .. .. .. .. | 26574 | |

*Example* 2. (*Six* figs.) Find the No. to the log. 424471.

| | | |
|---|---|---|
| Given log. .. .. .. .. .. .. .. .. | 424471 | |
| Next less (2657) .. .. .. .. .. .. .. | 424392 | 79 |
| Next greater .. .. .. .. .. .. .. .. | 424555 | 163 |

Then 7900 ÷ by 163, gives 48, and the numb. req. is 265748.

Table XXVI. *Logarithmic Sines, Cosines, Tangents, Cotangents, Secants, and Cosecants.*—The Table contains the terms to half-minutes, and to six places.

The second column and the last but one contain a time scale, corresponding to the upper and lower degree; thus 73° 33′ 30″ corresponds to 4h. 54m. 14s. This scale is very convenient for converting arc and time, but it is introduced to suit those computations in which the time itself is an argument.

The parts for each second are given beyond 9°; from 4° to 9°, to each 10″; but under 4° the variation is too rapid for their insertion, and the mean differences are given in the column marked D.* The parts are true for the *middle* term of the argument; thus, the parts from 20° 30′ to 20° 45′ are true for 20° 37½′, and approximate for the rest, but the inaccuracy in the extreme case corresponds only to ⅓ of 1″.

It is, of course, the more correct way to take the parts with reference to the *nearest* term, and to apply them accordingly; thus, to find the sine of 9° 40′ 28″, find it for 9° 40′ 30″, and *subtract* the parts for 2″.

For greater accuracy proceed by proportion.

*Direct Process.* When the given angle is less than 45°, its log. sine, &c. are taken from the top; when greater than 45°, from the bottom; thus, the log. sine of 28° 17′ is 9·675624; the log. sine of 84° 3′ is 9·997654. In like manner, the log. sine 9·452060 corresponds to the arc 16° 27′, the cotangent 9·47714 to the arc 73° 18′.

The log. sine of an angle is the log. cosine of the complement of the angle to 90°, whether in excess or defect; so, likewise, the log. cosine is the log. sine of the complement; and the like holds of the tangent and cotangent, secant and cosecant.

When the given angle exceeds 90°, find the log. sine, tangent, or secant, for the supplement to 180°. But it is generally easier to find the log. *co*-sine, *co*-tangent, and *co*-secant, for the *excess* above 90°.

*Example* 1.—The log. sine of 127° 50′ is the log. sine of 52° 10′, or the log. cos. of 37° 50′, which is 9·897516.

*Example* 2.—The log. cos. of 163° 49′ is the log. cos. of 16° 11′, or the log. sine of 73° 49′, which is 9·982441.

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* The diff. D., in the early portion (inserted merely for uniformity), is not that of two consecutive terms, but corresponds to *half* the tabular interval on *both* sides of a term. This is done to avoid breaking the continuity of the horizontal lines, which must occur when actual diffs. are exhibited, and is teasing to the eye.

*Example* 3.—The log. cosec. of 97° 4′ is the log. cosec. of 82° 56′, or the log. sec. of 7° 4′, which is 0·003312.

In like manner to find the log. *co*-sine, *co*-tangent, or *co*-secant, of an arc above 90°, take out the log. sine, tangent, or secant, of the excess above 90°.

To find the log. sine, &c. of an arc given to seconds. Find the log. sine (or cosine, &c.) for the next less minute or half-minute; take out the parts for the seconds, or for the excess above 30″.

For the sine, tangent, and secant, *add* the parts.

For the *co*-sine, *co*-tangent, and *co*-secant, *subtract* them.

*Example* 1.—Find the log. sine of 53° 25′ 13″.

| | | |
|---|---|---|
| ° ′ ″ | | |
| 53 25 0 sine | .. .. .. .. .. .. .. .. | 9·904711 |
| 13 parts | .. .. .. .. .. .. .. .. | + 20 |
| Log. sine req. | .. .. .. .. .. .. .. .. | 9·904731 |

*Example* 2.—Find the log. tan. of 11° 19′ 54″.

| | | |
|---|---|---|
| ° ′ ″ | | |
| 11 19 30 tan.. | .. .. .. .. .. .. .. .. | 9·301624 |
| 24 parts | .. .. .. .. .. .. .. .. | + 262 |
| Log. tan. req. | .. .. .. .. .. .. .. .. | 9·301886 |

*Example* 3.—Find the log. sec. of 38° 42′ 46″.

| | | |
|---|---|---|
| ° ′ ″ | | |
| 38 42 30 | .. .. .. .. .. .. .. .. | 0·107716 |
| 16 parts | .. .. .. .. .. .. .. .. | + 27 |
| Log. sec. req. | .. .. .. .. .. .. .. .. | 0·107743 |

*Example* 4.—Find the log. cosine of 72° 10′ 45″.

| | | |
|---|---|---|
| ° ′ ″ | | |
| 72 10 30 | .. .. .. .. .. .. .. .. | 9·485879 |
| 15 parts | .. .. .. .. .. .. .. .. | − 98 |
| Log. cos. req. | .. .. .. .. .. .. .. .. | 9·485781 |

*Example* 5.—Find the log. cotang. of 84° 3′ 22″.

| | | |
|---|---|---|
| ° ′ ″ | | |
| 84 3 0 cot... | .. .. .. .. .. .. .. .. | 9·017959 |
| 20 parts 408; 2 41 | .. .. .. .. .. .. .. .. | − 449 |
| Log. cotang. req. | .. .. .. .. .. .. .. .. | 9·017510 |

*Example* 6.—Find the log. cosec. of 68° 14′ 11″.

| ° ′ ″ | | |
|---|---|---|
| 68 14 | 0 cosec. .. .. .. .. .. .. .. .. .. | 0·032124 |
| | 11 parts .. .. .. .. .. .. .. .. .. | −9 |
| Log. cosec. req. .. .. .. .. .. .. .. .. | | 0·032115 |

In working to five places, the last figure of the parts must be dropped, the remainder being increased by 1 when the figure dropped exceeds 5.

In working to 1s. of time, the parts for 15″ are to be employed. In the earlier part of the Table, *half* the D. for 30″ may be conveniently employed.

It is convenient, in dealing with parts of contrary application, to mark those *additive* with +, and *subtractive* with −; to sum each kind separately; and to take the diff. of the two sums, marking it with the sign of the greater.

*Inverse Process.* To find the Arc, to seconds, corresponding to a given log. sine, &c.:

For the sine, tangent, or secant, take out the next *less*; for the *co*-sine, *co*-tangent, or *co*-secant, take out the next *greater*; and note the degree and minute, or half-minute, of the quantity thus taken out.

Take the diff. between this quantity and the given one; find the remainder in the column of Parts; take out the seconds corresponding and *add* them to the arc noted.

*Example* 1.—Find the arc to the log. sine 9·202470.

| | ° ′ ″ | | |
|---|---|---|---|
| | 9 10 0 | Given .. .. .. .. .. | 9·202470 |
| | | Next less .. .. .. | 9·202234 |
| | 18 | Rem. .. .. .. .. | 236 |
| Arc req. .. .. .. | 9 10 18 | | |

*Example* 2.—Find the arc to the log. cosine 9·897796.

| | ° ′ ″ | | |
|---|---|---|---|
| | 37 47 0 | Given .. .. .. .. .. | 9·897796 |
| | | Next greater.. .. .. | 9·897810 |
| | 8 | Rem. .. .. .. .. | 14 |
| Arc req. .. .. .. | 37 47 8 | | |

When the parts are not given for seconds beyond 10 (as for the log. sine and tang. from 4° to 8°), if the remainder exceeds the parts given,

take away the parts for 10″ or 20″; add 10″ or 20″ accordingly, and also the seconds corresponding to this last remainder.

*Example* 1.—Find the arc to the log tangent 9·127945.

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| | | | | Given .. .. .. .. .. | 9·127945 |
| | 7 | 38 | 30 | Next less .. .. .. .. | 9·127651 |
| | | | | | 294 |
| | | | 10 | Parts .. .. .. .. | 160 |
| | | | 8 | Rem. .. .. .. .. | 134 |
| Arc req. .. .. .. | 7 | 38 | 48 | | |

*Example* 2.—Find the arc. to the log. cosec. 10·881005.

| | ° | ′ | ″ | | |
|---|---|---|---|---|---|
| | | | | Given .. .. .. .. .. | 10.881005 |
| | 7 | 33 | 0 | Next greater .. .. | 10·881433 |
| | | | | | 428 |
| | | | 20 | Parts .. .. .. .. | 318 |
| | | | 7 | Rem. .. .. .. .. | 110 |
| Arc req. .. .. .. | 7 | 33 | 27 | | |

When greater precision than that afforded by the parts is required, the log. sine, &c., or the arc may be found by means of the proportional part of the diff. between two terms, or for 30″.

The log. cosec. is the arith. compl. of the log. sine.

The log. cotan. is the ar. co. of the log. tan.

The log. sec. is the ar. co. of the log. cosine.

The log. tan. is the sum of the log. sine and log. secant; thus all may be obtained from the log. sine.

Table XXVII. *Proportional Logarithms.*—These logarithms are given to every second of time, or arc, for 3h. or 3°. The Table is entered with the hour or degree and the minute at the top, and the second at the side; thus the prop. log. of 1° 2′ 27″ or of 1h. 2m. 27s. is 4597, that of 1m. 2s. is 2·2410. The index 0 proper to quantities above 19m. (or 19′) is suppressed for convenience.

To find the prop. log. of an arc under 18′, to the tenth of a second. Put the proper index, and find the decimal part due to ten times the arc.

*Example.*—Find the prop. log. of 7′ 13″·7; the index of 7′ 13″ is 1; the

dec. part of the log. due to 70′ 137″, or 72′ 17″, is 3962, the prop. log. required is 1·3962.

So the prop. log. of an arc, under 1′ 48″ may be found to the hundredth of a second by multiplying by 100.

To find the arc or time to the *tenth* of a second to a given prop. log. exceeding 1·0000. Look in the Table till the decimal part again occurs, and divide the arc by 10.

*Example.*—Find the time to the prop. log. 2·5106. Look for 1·5106; the nearest found is 1·5110, against 5m. 33s., or 333s.; hence the time required is 33s.·3.

Four places are enough for common purposes; but since the fourth place ceases to change by 1 after 1h. 13m., a greater time than this cannot be found truly to 1s. So also, a time exceeding 2h. 25m. cannot be found truly to 2s. This defect may be avoided in some cases by employing the complement of the interval to 3h.

Table XXVIII. *Natural Cosines.*—This table gives the natural cosines of angles from 0° to 90°. The several columns of cosines are headed by degrees, the accompanying minutes being inserted in the first column on the left of the page; this is equally a column of seconds, and is accordingly headed with the marks for minutes and seconds. The number of degrees and minutes of an arc or angle is found in the column of cosines under the degrees and in a line with the minutes found in the first column; if there are seconds also in the arc or angle, again refer to the first column for these, and in the same horizontal line with them in the column headed "parts for," next to the column from which the cosine has been extracted, will be found the correction for seconds, which is always to be *subtracted*, and the remainder will be the cosine of the given degrees, minutes, and seconds. When the angle or arc for which the cosine is required is greater than 90°, the table must be entered with its supplement and the corresponding cosine regarded as negative. The decimal points have not been inserted before each cosine; and in computation, the numbers may always be regarded as integers.

*Example* 1. Suppose the natural cosine of 39° 22′ 33″ were required: Turning to the page containing 39 on the top, we find "parts" against 33″ to be 103, and the cosine against 22′ to be 773103; subtracting 103 from this, we get the cosine required, 773000.

2. Required the cosine for 120° 18′ 20″: the supplement of this is

59° 41′ 40″ Under 59° and against 40″ we find 168 parts, and against 41′ the cosine is 504779; subtracting the 168 from this 504611, which is negative because the proposed angle is greater than 90°. Since the sine of any angle is the cosine of its complement, the sine of an angle may be obtained from this table, by taking out the cosine of the defect from, or the excess above 90° The sine of 50° 37′ 27″ is, for instance, the same as the cosine of 39° 22′ 33″: and the sine of 149° 41′ 40″ is the same as the cosine of 59° 41′ 40″. The tangent of an angle is its sine divided by its cosine, and may be also readily found from this table.

3. Required the angle whose cosine is 568293:

| | | |
|---|---|---|
| | | ° ′ |
| By the table .. .. .. .. .. .. .. | 568323 | = 55 22 |
| Given cosine .. .. .. .. .. .. .. | 568293 | |
| | | ″ |
| Parts for secs. .. .. .. .. .. .. | 30 | = 7·5 |

Angle required is 55° 22′ 7″·5.

If the cosine given had been negative − 568293, the supplement of this angle, namely 124° 37′ 52″·5, would have been the angle to which that cosine belongs.

Tables XXIX and XXX.—These tables contain the corresponding divisions of Time and Arc.

Table XXXI. *Acceleration.*—This is the change of the sun's mean Right Ascension in a mean solar day. It is employed in reducing the Sidereal Time at mean noon to the Green. Date, and in converting Mean Time into Sidereal Time.

The Acceleration is itself a portion of Sidereal Time.

Table XXXII. *Retardation.*—This is the change of the sun's mean Right Ascension in a sidereal day. It is employed in converting Sidereal Time into Mean Time.

The Retardation is itself a portion of Mean Time.

Table XXXIII. *Parallax in Altitude of a Planet.*—The Table is entered with the Planet's Horizontal Parallax at the top, and its Altitude at the side; and the corresponding seconds taken out.

*To compute a Term.* Enter the Traverse Table with the alt. as course and the hor. par. as dist., and take out the D. Lat.

Table XXXIV. *Diminution of the Moon's Horizontal Parallax for the Spheroidal Figure of the Earth.*—The Table is entered with the Horizontal

Parallax at the top and the Latitude at the side; the seconds corresponding are to be *subtracted* from the equatorial hor. par.

The compression employed is $\frac{1}{300}$.

Table XXXV. *Reduction of the Latitude.*—This is the difference between the latitude as actually found by any astronomical observation and what it would be if the earth were a sphere, which last is called the *geocentric* latitude.

To reduce the lat. by observation to the geocentric latitude, *subtract* the reduction of latitude.

This quantity, which is also called the *angle of the vertical*, is 0 at the equator and at the pole, and is greatest in lat. 45°.

The compression assumed is $\frac{1}{300}$; that is, the polar radius is supposed to be shorter than the equatorial radius by $\frac{1}{300}$ of the latter.

Table XXXVI. *Augmentation of the Moon's Semidiameter.*—The table is entered with the Moon's Semidiameter at the top and her altitude at the side; the seconds corresponding are the excess by which her apparent semidiameter exceeds that at which it would appear if seen from the centre of the earth.

## TABLE I.

DECLINATION OF THE SUN FOR THE YEARS 1899 AND 1903 AT MEAN NOON AT GREENWICH.

| Day. 1899. | Day. 1903. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1 | 2 | S. 23 0 | S. 17 4 | S. 7 33 | N. 4 34 | N. 15 6 | N. 22 4 | N. 23 7 | N. 18 1 | N. 8 17 | S. 3 12 | S. 14 28 | S. 21 50 |
| 2 | 3 | 22 55 | 16 47 | 7 10 | 4 57 | 15 24 | 22 12 | 23 3 | 17 46 | 7 55 | 3 36 | 14 47 | 21 59 |
| 3 | 4 | 22 49 | 16 30 | 6 47 | 5 20 | 15 42 | 22 20 | 22 58 | 17 31 | 7 33 | 3 59 | 15 6 | 22 7 |
| 4 | 5 | 22 43 | 16 12 | 6 24 | 5 43 | 15 59 | 22 27 | 22 53 | 17 15 | 7 11 | 4 22 | 15 24 | 22 16 |
| 5 | 6 | 22 37 | 15 54 | 6 1 | 6 6 | 16 16 | 22 34 | 22 48 | 16 59 | 6 48 | 4 45 | 15 43 | 22 24 |
| 6 | 7 | 22 30 | 15 35 | 5 38 | 6 29 | 16 33 | 22 40 | 22 42 | 16 42 | 6 26 | 5 8 | 16 1 | 22 31 |
| 7 | 8 | 22 22 | 15 17 | 5 15 | 6 51 | 16 50 | 22 46 | 22 36 | 16 26 | 6 4 | 5 31 | 16 19 | 22 38 |
| 8 | 9 | 22 14 | 14 58 | 4 51 | 7 14 | 17 6 | 22 52 | 22 29 | 16 9 | 5 41 | 5 54 | 16 36 | 22 44 |
| 9 | 10 | 22 6 | 14 39 | 4 28 | 7 36 | 17 23 | 22 57 | 22 22 | 15 51 | 5 18 | 6 17 | 16 53 | 22 50 |
| 10 | 11 | 21 57 | 14 19 | 4 4 | 7 58 | 17 38 | 23 1 | 22 15 | 15 34 | 4 56 | 6 40 | 17 10 | 22 56 |
| 11 | 12 | 21 48 | 13 59 | 3 41 | 8 21 | 17 54 | 23 6 | 22 7 | 15 16 | 4 33 | 7 3 | 17 27 | 23 1 |
| 12 | 13 | 21 38 | 13 40 | 3 17 | 8 43 | 18 9 | 23 10 | 21 59 | 14 58 | 4 10 | 7 25 | 17 44 | 23 6 |
| 13 | 14 | 21 28 | 13 20 | 2 54 | 9 4 | 18 24 | 23 13 | 21 50 | 14 40 | 3 47 | 7 48 | 18 0 | 23 10 |
| 14 | 15 | 21 18 | 12 59 | 2 30 | 9 26 | 18 39 | 23 17 | 21 41 | 14 22 | 3 24 | 8 10 | 18 15 | 23 14 |
| 15 | 16 | 21 7 | 12 39 | 2 6 | 9 48 | 18 53 | 23 19 | 21 32 | 14 3 | 3 1 | 8 33 | 18 31 | 23 17 |
| 16 | 17 | 20 55 | 12 18 | 1 43 | 10 9 | 19 7 | 23 22 | 21 22 | 13 44 | 2 38 | 8 55 | 18 46 | 23 20 |
| 17 | 18 | 20 44 | 11 57 | 1 19 | 10 30 | 19 21 | 23 24 | 21 12 | 13 25 | 2 15 | 9 17 | 19 1 | 23 22 |
| 18 | 19 | 20 32 | 11 36 | 0 55 | 10 51 | 19 34 | 23 25 | 21 2 | 13 6 | 1 51 | 9 39 | 19 15 | 23 24 |
| 19 | 20 | 20 19 | 11 15 | 0 31 | 11 12 | 19 47 | 23 26 | 20 51 | 12 46 | 1 28 | 10 0 | 19 29 | 23 26 |
| 20 | 21 | 20 6 | 10 53 | S. 0 8 | 11 32 | 20 0 | 23 27 | 20 40 | 12 27 | 1 5 | 10 22 | 19 43 | 23 27 |
| 21 | 22 | 19 53 | 10 31 | N. 0 16 | 11 53 | 20 12 | 23 27 | 20 29 | 12 7 | 0 41 | 10 44 | 19 57 | 23 27 |
| 22 | 23 | 19 39 | 10 10 | 0 40 | 12 13 | 20 24 | 23 27 | 20 17 | 11 47 | N. 0 18 | 11 5 | 20 10 | 23 27 |
| 23 | 24 | 19 25 | 9 48 | 1 3 | 12 33 | 20 36 | 23 26 | 20 5 | 11 27 | S. 0 5 | 11 26 | 20 22 | 23 27 |
| 24 | 25 | 19 11 | 9 26 | 1 27 | 12 53 | 20 47 | 23 25 | 19 53 | 11 6 | 0 29 | 11 47 | 20 35 | 23 26 |
| 25 | 26 | 18 56 | 9 3 | 1 51 | 13 13 | 20 58 | 23 24 | 19 40 | 10 45 | 0 52 | 12 8 | 20 47 | 23 24 |
| 26 | 27 | 18 41 | 8 41 | 2 14 | 13 32 | 21 8 | 23 22 | 19 27 | 10 25 | 1 16 | 12 28 | 20 58 | 23 22 |
| 27 | 28 | 18 26 | 8 19 | 2 38 | 13 51 | 21 19 | 23 20 | 19 13 | 10 4 | 1 39 | 12 49 | 21 9 | 23 20 |
| 28 | 29 | 18 10 | S. 7 56 | 3 1 | 14 10 | 21 28 | 23 17 | 18 59 | 9 43 | 2 2 | 13 9 | 21 20 | 23 17 |
| 29 | 30 | 17 54 | .. | 3 24 | 14 29 | 21 38 | 23 14 | 18 45 | 9 21 | 2 26 | 13 29 | 21 30 | 23 14 |
| 30 | 31 | 17 38 | .. | 3 48 | N. 14 48 | 21 47 | N. 23 11 | 18 31 | 9 0 | S. 2 49 | 13 49 | S. 21 40 | 23 10 |
| 31 | .. | 17 21 | .. | 4 11 | .. | 21 56 | .. | 18 16 | 8 38 | .. | 14 8 | .. | 23 6 |

## TABLE I.—(*continued*).

DECLINATION OF THE SUN FOR THE YEARS 1900 AND 1904 AT MEAN NOON AT GREENWICH.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1 | S. 23 1 | S. 17 9 | S. 7 39 | N. 4 29 | N. 15 1 | N. 22 2 | N. 23 8 | N. 18 5 | N. 8 22 | S. 3 7 | S. 14 23 | S 21 47 |
| 2 | 22 56 | 16 51 | 7 16 | 4 52 | 15 19 | 22 10 | 23 4 | 17 50 | 8 0 | 3 30 | 14 42 | 21 57 |
| 3 | 22 51 | 16 34 | 6 53 | 5 15 | 15 37 | 22 18 | 22 59 | 17 34 | 7 38 | 3 53 | 15 1 | 22 5 |
| 4 | 22 45 | 16 16 | 6 30 | 5 38 | 15 55 | 22 25 | 22 54 | 17 19 | 7 16 | 4 17 | 15 20 | 22 14 |
| 5 | 22 38 | 15 58 | 6 7 | 6 1 | 16 12 | 22 32 | 22 49 | 17 3 | 6 54 | 4 40 | 15 38 | 22 22 |
| 6 | 22 31 | 15 40 | 5 43 | 6 23 | 16 29 | 22 38 | 22 43 | 16 46 | 6 31 | 5 3 | 15 56 | 22 29 |
| 7 | 22 24 | 15 21 | 5 20 | 6 46 | 16 46 | 22 44 | 22 37 | 16 30 | 6 9 | 5 26 | 16 14 | 22 36 |
| 8 | 22 16 | 15 2 | 4 57 | 7 8 | 17 2 | 22 50 | 22 31 | 16 13 | 5 47 | 5 49 | 16 32 | 22 43 |
| 9 | 22 8 | 14 43 | 4 33 | 7 31 | 17 19 | 22 55 | 22 24 | 15 56 | 5 24 | 6 12 | 16 49 | 22 49 |
| 10 | 21 59 | 14 24 | 4 10 | 7 53 | 17 35 | 23 0 | 22 17 | 15 38 | 5 1 | 6 34 | 17 6 | 22 55 |
| 11 | 21 50 | 14 4 | 3 46 | 8 15 | 17 50 | 23 5 | 22 9 | 15 21 | 4 38 | 6 57 | 17 23 | 23 0 |
| 12 | 21 40 | 13 44 | 3 23 | 8 37 | 18 5 | 23 9 | 22 1 | 15 3 | 4 16 | 7 20 | 17 40 | 23 5 |
| 13 | 21 30 | 13 24 | 2 59 | 8 59 | 18 20 | 23 13 | 21 52 | 14 45 | 3 53 | 7 42 | 17 56 | 23 9 |
| 14 | 21 20 | 13 4 | 2 36 | 9 21 | 18 35 | 23 16 | 21 44 | 14 26 | 3 30 | 8 5 | 18 12 | 23 13 |
| 15 | 21 9 | 12 44 | 2 12 | 9 42 | 18 49 | 23 19 | 21 34 | 14 8 | 3 7 | 8 27 | 18 27 | 23 16 |
| 16 | 20 58 | 12 23 | 1 48 | 10 4 | 19 4 | 23 21 | 21 25 | 13 49 | 2 43 | 8 49 | 18 42 | 23 19 |
| 17 | 20 46 | 12 2 | 1 25 | 10 25 | 19 17 | 23 23 | 21 15 | 13 30 | 2 20 | 9 11 | 18 57 | 23 22 |
| 18 | 20 34 | 11 41 | 1 1 | 10 46 | 19 31 | 23 25 | 21 5 | 13 11 | 1 57 | 9 33 | 19 12 | 23 24 |
| 19 | 20 22 | 11 20 | 0 37 | 11 7 | 19 44 | 23 26 | 20 54 | 12 51 | 1 34 | 9 55 | 19 26 | 23 25 |
| 20 | 20 9 | 10 58 | S. 0 13 | 11 27 | 19 57 | 23 27 | 20 43 | 12 32 | 1 10 | 10 17 | 19 40 | 23 26 |
| 21 | 19 56 | 10 37 | N. 0 10 | 11 48 | 20 9 | 23 27 | 20 32 | 12 12 | 0 47 | 10 38 | 19 53 | 23 27 |
| 22 | 19 43 | 10 15 | 0 34 | 12 8 | 20 21 | 23 27 | 20 20 | 11 52 | 0 24 | 11 0 | 20 6 | 23 27 |
| 23 | 19 29 | 9 53 | 0 58 | 12 28 | 20 33 | 23 27 | 20 8 | 11 31 | N. 0 0 | 11 21 | 20 19 | 23 27 |
| 24 | 19 15 | 9 31 | 1 21 | 12 48 | 20 44 | 23 26 | 19 56 | 11 11 | S. 0 23 | 11 42 | 20 32 | 23 26 |
| 25 | 19 0 | 9 9 | 1 45 | 13 8 | 20 55 | 23 24 | 19 43 | 10 50 | 0 47 | 12 3 | 20 44 | 23 25 |
| 26 | 18 45 | 8 46 | 2 8 | 13 27 | 21 6 | 23 23 | 19 30 | 10 30 | 1 10 | 12 23 | 20 55 | 23 23 |
| 27 | 18 30 | 8 24 | 2 32 | 13 47 | 21 16 | 23 21 | 19 16 | 10 9 | 1 33 | 12 44 | 21 7 | 23 21 |
| 28 | 18 14 | S. 8 1 | 2 55 | 14 6 | 21 26 | 23 18 | 19 3 | 9 48 | 1 57 | 13 4 | 21 17 | 23 18 |
| 29 | 17 58 | .. | 3 19 | 14 25 | 21 36 | 23 15 | 18 49 | 9 26 | 2 20 | 13 24 | 21 28 | 23 15 |
| 30 | 17 42 | .. | 3 42 | N. 14 43 | 21 45 | N. 23 12 | 18 35 | 9 5 | S. 2 43 | 13 44 | S. 21 38 | 23 11 |
| 31 | S. 17 25 | .. | N. 4 5 | .. | N. 21 54 | .. | N. 18 20 | N. 8 43 | .. | S. 14 4 | .. | S. 23 7 |

## TABLE I.—(*continued*).

### DECLINATION OF THE SUN FOR THE YEARS 1901 AND 1905 AT MEAN NOON AT GREENWICH.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' | ° ' |
| 1 | S.23 2 | S.17 13 | S.7 44 | N.4 23 | N.14 57 | N.22 0 | N.23 9 | N.18 9 | N.8 27 | S.3 1 | S.14 18 | S.21 45 |
| 2 | 22 57 | 16 55 | 7 21 | 4 46 | 15 15 | 22 8 | 23 5 | 17 54 | 8 5 | 3 24 | 14 37 | 21 54 |
| 3 | 22 52 | 16 38 | 6 58 | 5 9 | 15 33 | 22 16 | 23 1 | 17 38 | 7 43 | 3 48 | 14 56 | 22 3 |
| 4 | 22 46 | 16 20 | 6 35 | 5 32 | 15 51 | 22 23 | 22 56 | 17 22 | 7 21 | 4 11 | 15 15 | 22 12 |
| 5 | 22 40 | 16 2 | 6 12 | 5 55 | 16 8 | 22 30 | 22 50 | 17 7 | 6 59 | 4 34 | 15 34 | 22 20 |
| 6 | 22 33 | 15 44 | 5 49 | 6 18 | 16 25 | 22 37 | 22 45 | 16 50 | 6 37 | 4 57 | 15 52 | 22 27 |
| 7 | 22 26 | 15 26 | 5 26 | 6 40 | 16 42 | 22 43 | 22 39 | 16 34 | 6 15 | 5 20 | 16 10 | 22 34 |
| 8 | 22 18 | 15 7 | 5 3 | 7 3 | 16 58 | 22 49 | 22 32 | 16 17 | 5 52 | 5 43 | 16 28 | 22 41 |
| 9 | 22 10 | 14 48 | 4 39 | 7 25 | 17 15 | 22 54 | 22 26 | 16 0 | 5 29 | 6 6 | 16 45 | 22 47 |
| 10 | 22 1 | 14 29 | 4 16 | 7 48 | 17 31 | 22 59 | 22 18 | 15 43 | 5 7 | 6 29 | 17 2 | 22 53 |
| 11 | 21 52 | 14 9 | 3 52 | 8 10 | 17 46 | 23 4 | 22 11 | 15 25 | 4 44 | 6 52 | 17 19 | 22 59 |
| 12 | 21 43 | 13 49 | 3 29 | 8 32 | 18 2 | 23 8 | 22 3 | 15 7 | 4 21 | 7 14 | 17 36 | 23 3 |
| 13 | 21 33 | 13 29 | 3 5 | 8 54 | 18 17 | 23 12 | 21 54 | 14 49 | 3 58 | 7 37 | 17 52 | 23 8 |
| 14 | 21 23 | 13 9 | 2 41 | 9 15 | 18 32 | 23 15 | 21 46 | 14 31 | 3 35 | 7 59 | 18 8 | 23 12 |
| 15 | 21 12 | 12 49 | 2 18 | 9 37 | 18 46 | 23 18 | 21 37 | 14 12 | 3 12 | 8 22 | 18 23 | 23 15 |
| 16 | 21 1 | 12 28 | 1 54 | 9 58 | 19 0 | 23 20 | 21 27 | 13 54 | 2 49 | 8 44 | 18 39 | 23 18 |
| 17 | 20 49 | 12 7 | 1 30 | 10 20 | 19 14 | 23 23 | 21 17 | 13 35 | 2 26 | 9 6 | 18 54 | 23 21 |
| 18 | 20 37 | 11 46 | 1 7 | 10 41 | 19 27 | 23 24 | 21 7 | 13 15 | 2 3 | 9 28 | 19 8 | 23 23 |
| 19 | 20 25 | 11 25 | 0 43 | 11 2 | 19 41 | 23 26 | 20 56 | 12 56 | 1 39 | 9 50 | 19 23 | 23 25 |
| 20 | 20 12 | 11 3 | S.0 19 | 11 22 | 19 53 | 23 26 | 20 46 | 12 36 | 1 16 | 10 12 | 19 36 | 23 26 |
| 21 | 19 59 | 10 42 | N.0 5 | 11 43 | 20 6 | 23 27 | 20 34 | 12 17 | 0 53 | 10 33 | 19 50 | 23 27 |
| 22 | 19 46 | 10 20 | 0 28 | 12 3 | 20 18 | 23 27 | 20 23 | 11 57 | 0 29 | 10 54 | 20 3 | 23 27 |
| 23 | 19 32 | 9 58 | 0 52 | 12 24 | 20 30 | 23 27 | 20 11 | 11 36 | N.0 6 | 11 16 | 20 16 | 23 27 |
| 24 | 19 18 | 9 36 | 1 16 | 12 43 | 20 41 | 23 26 | 19 59 | 11 16 | S.0 17 | 11 37 | 20 29 | 23 26 |
| 25 | 19 4 | 9 14 | 1 39 | 13 3 | 20 52 | 23 25 | 19 46 | 10 55 | 0 41 | 11 58 | 20 41 | 23 25 |
| 26 | 18 49 | 8 52 | 2 3 | 13 23 | 21 3 | 23 23 | 19 33 | 10 35 | 1 4 | 12 18 | 20 52 | 23 23 |
| 27 | 18 33 | 8 29 | 2 26 | 13 42 | 21 14 | 23 21 | 19 20 | 10 14 | 1 28 | 12 39 | 21 4 | 23 21 |
| 28 | 18 18 | S.8 7 | 2 50 | 14 1 | 21 24 | 23 19 | 19 6 | 9 53 | 1 51 | 12 59 | 21 15 | 23 19 |
| 29 | 18 2 | .. | 3 13 | 14 20 | 21 33 | 23 16 | 18 52 | 9 32 | 2 14 | 13 19 | 21 25 | 23 16 |
| 30 | 17 46 | .. | 3 37 | N.14 39 | 21 43 | N.23 13 | 18 38 | 9 10 | S.2 38 | 13 39 | S.21 35 | 23 12 |
| 31 | S.17 29 | .. | N.4 0 | .. | N.21 51 | .. | N.18 24 | N. 8 49 | .. | S.13 59 | .. | S.23 8 |

## TABLE I.—(*continued*).

DECLINATION OF THE SUN FOR THE YEARS 1902 AND 1906 AT MEAN NOON AT GREENWICH.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ | ° ′ |
| 1 | S. 23 4 | S. 17 17 | S. 7 50 | N. 4 17 | N. 14 52 | N. 21 58 | N. 23 10 | N. 18 12 | N. 8 32 | S. 2 55 | S. 14 14 | S. 21 43 |
| 2 | 22 59 | 17 0 | 7 27 | 4 40 | 15 11 | 22 6 | 23 6 | 17 57 | 8 10 | 3 19 | 14 33 | 21 52 |
| 3 | 22 53 | 16 42 | 7 4 | 5 3 | 15 29 | 22 14 | 23 2 | 17 42 | 7 49 | 3 42 | 14 52 | 22 1 |
| 4 | 22 48 | 16 25 | 6 41 | 5 26 | 15 46 | 22 21 | 22 57 | 17 26 | 7 27 | 4 5 | 15 11 | 22 10 |
| 5 | 22 41 | 16 7 | 6 18 | 5 49 | 16 4 | 22 28 | 22 52 | 17 10 | 7 4 | 4 29 | 15 29 | 22 18 |
| 6 | 22 35 | 15 49 | 5 55 | 6 12 | 16 21 | 22 35 | 22 46 | 16 54 | 6 42 | 4 52 | 15 47 | 22 25 |
| 7 | 22 27 | 15 30 | 5 32 | 6 35 | 16 38 | 22 41 | 22 40 | 16 38 | 6 20 | 5 15 | 16 6 | 22 33 |
| 8 | 22 20 | 15 11 | 5 8 | 6 57 | 16 54 | 22 47 | 22 34 | 16 21 | 5 57 | 5 38 | 16 23 | 22 39 |
| 9 | 22 12 | 14 52 | 4 45 | 7 20 | 17 11 | 22 53 | 22 27 | 16 4 | 5 35 | 6 1 | 16 41 | 22 46 |
| 10 | 22 3 | 14 33 | 4 21 | 7 42 | 17 27 | 22 58 | 22 20 | 15 47 | 5 12 | 6 24 | 16 58 | 22 52 |
| 11 | 21 54 | 14 14 | 3 58 | 8 4 | 17 42 | 23 3 | 22 12 | 15 29 | 4 49 | 6 46 | 17 15 | 22 57 |
| 12 | 21 45 | 13 54 | 3 34 | 8 26 | 17 58 | 23 7 | 22 5 | 15 11 | 4 27 | 7 9 | 17 32 | 23 2 |
| 13 | 21 35 | 13 34 | 3 11 | 8 48 | 18 13 | 23 11 | 21 56 | 14 53 | 4 4 | 7 32 | 17 48 | 23 7 |
| 14 | 21 25 | 13 14 | 2 47 | 9 10 | 18 28 | 23 14 | 21 48 | 14 35 | 3 41 | 7 54 | 18 4 | 23 11 |
| 15 | 21 15 | 12 54 | 2 23 | 9 32 | 18 42 | 23 17 | 21 39 | 14 17 | 3 18 | 8 16 | 18 20 | 23 15 |
| 16 | 21 4 | 12 33 | 2 0 | 9 53 | 18 57 | 23 20 | 21 29 | 13 58 | 2 55 | 8 39 | 18 35 | 23 18 |
| 17 | 20 52 | 12 12 | 1 36 | 10 15 | 19 11 | 23 22 | 21 20 | 13 39 | 2 31 | 9 1 | 18 50 | 23 20 |
| 18 | 20 40 | 11 51 | 1 12 | 10 36 | 19 24 | 23 24 | 21 9 | 13 20 | 2 8 | 9 23 | 19 5 | 23 23 |
| 19 | 20 28 | 11 30 | 0 50 | 10 57 | 19 37 | 23 25 | 20 59 | 13 1 | 1 45 | 9 45 | 19 19 | 23 24 |
| 20 | 20 16 | 11 9 | 0 25 | 11 17 | 19 50 | 23 26 | 20 48 | 12 41 | 1 22 | 10 6 | 19 33 | 23 26 |
| 21 | 20 3 | 10 47 | S. 0 1 | 11 38 | 20 3 | 23 27 | 20 37 | 12 21 | 0 58 | 10 28 | 19 47 | 23 27 |
| 22 | 19 49 | 10 26 | N. 0 22 | 11 58 | 20 15 | 23 27 | 20 26 | 12 1 | 0 35 | 10 49 | 20 0 | 23 27 |
| 23 | 19 36 | 10 4 | 0 46 | 12 19 | 20 27 | 23 27 | 20 14 | 11 41 | N. 0 12 | 11 11 | 20 13 | 23 27 |
| 24 | 19 22 | 9 42 | 1 10 | 12 39 | 20 39 | 23 26 | 20 1 | 11 21 | S. 0 12 | 11 32 | 20 26 | 23 26 |
| 25 | 19 7 | 9 20 | 1 33 | 12 58 | 20 50 | 23 25 | 19 49 | 11 0 | 0 35 | 11 53 | 20 38 | 23 25 |
| 26 | 18 52 | 8 57 | 1 57 | 13 18 | 21 1 | 23 23 | 19 36 | 10 40 | 0 59 | 12 13 | 20 50 | 23 24 |
| 27 | 18 37 | 8 35 | 2 20 | 13 37 | 21 11 | 23 22 | 19 23 | 10 19 | 1 22 | 12 34 | 21 1 | 23 22 |
| 28 | 18 22 | 8 12 | 2 44 | 13 56 | 21 21 | 23 19 | 19 9 | 9 58 | 1 45 | 12 54 | 21 12 | 23 19 |
| 29 | 18 6 | .. | 3 7 | 14 15 | 21 31 | 23 17 | 18 56 | 9 37 | 2 9 | 13 14 | 21 23 | 23 16 |
| 30 | 17 50 | .. | 3 31 | 14 34 | 21 40 | 23 13 | 18 41 | 9 15 | 2 32 | 13 34 | 21 33 | 23 13 |
| 31 | 17 34 | .. | 3 54 | .. | 21 49 | .. | 18 27 | 8 54 | .. | 13 54 | .. | 23 9 |

## TABLE II.

EQUATION OF TIME FOR THE YEARS 1899 and 1903 FOR APPARENT NOON AT GREENWICH.

| Day. 1899 | Day. 1903 | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | m. s. Add | m. s. Add | m. s. Add | m. s. Add | m. s. Sub. | m. s. Sub. | m. s. Add | m. s. Add | m. s. Sub. | m. s. Sub. | m. s. Sub. | m. s. Sub. |
| 1 | 2 | 3 47 | 13 49 | 12 31 | 3 57 | 3 0 | 2 26 | 3 34 | 6 7 | 0 5 | 10 19 | 16 20 | 10 50 |
| 2 | 3 | 4 15 | 13 56 | 12 19 | 3 39 | 3 7 | 2 16 | 3 45 | 6 3 | 0 24 | 10 38 | 16 20 | 10 27 |
| 3 | 4 | 4 43 | 14 3 | 12 7 | 3 21 | 3 14 | 2 7 | 3 56 | 5 59 | 0 43 | 10 57 | 16 21 | 10 4 |
| 4 | 5 | 5 11 | 14 8 | 11 54 | 3 3 | 3 20 | 1 57 | 4 7 | 5 54 | 1 3 | 11 15 | 16 20 | 9 39 |
| 5 | 6 | 5 38 | 14 13 | 11 40 | 2 46 | 3 25 | 1 46 | 4 18 | 5 48 | 1 22 | 11 33 | 16 18 | 9 15 |
| 6 | 7 | 6 4 | 14 18 | 11 26 | 2 28 | 3 30 | 1 36 | 4 28 | 5 42 | 1 42 | 11 51 | 16 16 | 8 49 |
| 7 | 8 | 6 30 | 14 21 | 11 12 | 2 11 | 3 34 | 1 25 | 4 38 | 5 35 | 2 2 | 12 8 | 16 13 | 8 23 |
| 8 | 9 | 6 56 | 14 24 | 10 57 | 1 54 | 3 38 | 1 13 | 4 48 | 5 28 | 2 23 | 12 25 | 16 9 | 7 57 |
| 9 | 10 | 7 21 | 14 26 | 10 42 | 1 38 | 3 41 | 1 2 | 4 57 | 5 20 | 2 43 | 12 41 | 16 4 | 7 30 |
| 10 | 11 | 7 46 | 14 27 | 10 27 | 1 21 | 3 44 | 0 50 | 5 6 | 5 12 | 3 4 | 12 57 | 15 58 | 7 3 |
| 11 | 12 | 8 10 | 14 27 | 10 11 | 1 5 | 3 46 | 0 38 | 5 14 | 5 2 | 3 24 | 13 12 | 15 52 | 6 36 |
| 12 | 13 | 8 33 | 14 27 | 9 55 | 0 49 | 3 48 | 0 26 | 5 22 | 4 53 | 3 45 | 13 27 | 15 44 | 6 8 |
| 13 | 14 | 8 56 | 14 25 | 9 38 | 0 34 | 3 49 | 0 13 | 5 29 | 4 42 | 4 6 | 13 42 | 15 36 | 5 39 |
| 14 | 15 | 9 18 | 14 24 | 9 22 | 0 18 | 3 49 | 0 1 Add | 5 36 | 4 32 | 4 28 | 13 56 | 15 27 | 5 11 |
| 15 | 16 | 9 40 | 14 21 | 9 5 | 0 3 Sub. | 3 49 | 0 12 | 5 43 | 4 20 | 4 49 | 14 9 | 15 17 | 4 24 |
| 16 | 17 | 10 1 | 14 17 | 8 48 | 0 11 | 3 48 | 0 25 | 5 49 | 4 8 | 5 10 | 14 22 | 15 7 | 4 13 |
| 17 | 18 | 10 21 | 14 13 | 8 30 | 0 25 | 3 47 | 0 38 | 5 54 | 3 56 | 5 31 | 14 35 | 14 55 | 3 44 |
| 18 | 19 | 10 40 | 14 8 | 8 13 | 0 39 | 3 45 | 0 50 | 5 59 | 3 43 | 5 53 | 14 47 | 14 43 | 3 14 |
| 19 | 20 | 10 59 | 14 3 | 7 55 | 0 53 | 3 43 | 1 3 | 6 3 | 3 29 | 6 14 | 14 58 | 14 30 | 2 45 |
| 20 | 21 | 11 16 | 13 56 | 7 37 | 1 6 | 3 40 | 1 16 | 6 7 | 3 15 | 6 35 | 15 8 | 14 16 | 2 15 |
| 21 | 22 | 11 33 | 13 49 | 7 19 | 1 18 | 3 36 | 1 29 | 6 10 | 3 1 | 6 56 | 15 18 | 14 1 | 1 45 |
| 22 | 23 | 11 50 | 13 42 | 7 1 | 1 31 | 3 32 | 1 42 | 6 13 | 2 46 | 7 17 | 15 27 | 13 46 | 1 15 |
| 23 | 24 | 12 5 | 13 33 | 6 43 | 1 43 | 3 28 | 1 55 | 6 15 | 2 31 | 7 38 | 15 36 | 13 29 | 0 45 |
| 24 | 25 | 12 20 | 13 24 | 6 24 | 1 54 | 3 23 | 2 8 | 6 16 | 2 15 | 7 59 | 15 44 | 13 12 | 0 15 Add |
| 25 | 26 | 12 34 | 13 15 | 6 6 | 2 5 | 3 17 | 2 20 | 6 17 | 1 59 | 8 20 | 15 51 | 12 54 | 0 15 |
| 26 | 27 | 12 47 | 13 5 | 5 47 | 2 15 | 3 11 | 2 33 | 6 17 | 1 42 | 8 40 | 15 57 | 12 35 | 0 45 |
| 27 | 28 | 12 59 | 12 54 | 5 29 | 2 25 | 3 5 | 2 45 | 6 17 | 1 25 | 9 1 | 16 3 | 12 16 | 1 14 |
| 28 | 29 | 13 11 | 12 43 | 5 10 | 2 35 | 2 58 | 2 58 | 6 16 | 1 8 | 9 21 | 16 8 | 11 55 | 1 44 |
| 29 | 30 | 13 21 | .. | 4 52 | 2 43 | 2 51 | 3 10 | 6 15 | 0 50 | 9 40 | 16 12 | 11 34 | 2 13 |
| 30 | 31 | 13 31 | .. | 4 33 | 2 52 | 2 43 | 3 22 | 6 13 | 0 32 | 10 0 | 16 15 | 11 13 | 2 43 |
| 31 | .. | 13 40 | .. | 4 15 | .. | 2 34 | .. | 6 10 | 0 14 | .. | 16 18 | .. | 3 12 |

## TABLE II.—(*continued*).

### Equation of Time for the Years 1900 and 1904 for Apparent Noon at Greenwich.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. |
| | Add | Add | Add | Add | Sub. | Sub. | Add | Add | Sub. | Sub. | Sub. | Sub. |
| 1 | 3 40 | 13 47 | 12 35 | 4 2 | 2 57 | 2 27 | 3 31 | 6 8 | 0 0 | 10 14 | 16 19 | 10 55 |
| 2 | 4 9 | 13 55 | 12 23 | 3 44 | 3 4 | 2 18 | 3 43 | 6 4 | 0 19 | 10 33 | 16 20 | 10 32 |
| 3 | 4 37 | 14 2 | 12 10 | 3 26 | 3 11 | 2 8 | 3 54 | 6 0 | 0 38 | 10 52 | 16 20 | 10 9 |
| 4 | 5 4 | 14 8 | 11 57 | 3 8 | 3 17 | 1 59 | 4 5 | 5 55 | 0 58 | 11 11 | 16 20 | 9 45 |
| 5 | 5 31 | 14 13 | 11 44 | 2 51 | 3 23 | 1 48 | 4 16 | 5 50 | 1 18 | 11 29 | 16 19 | 9 21 |
| 6 | 5 58 | 14 17 | 11 30 | 2 33 | 3 28 | 1 38 | 4 26 | 5 44 | 1 38 | 11 47 | 16 17 | 8 56 |
| 7 | 6 24 | 14 21 | 11 16 | 2 16 | 3 33 | 1 27 | 4 36 | 5 37 | 1 58 | 12 4 | 16 14 | 8 30 |
| 8 | 6 50 | 14 24 | 11 1 | 1 59 | 3 37 | 1 16 | 4 45 | 5 29 | 2 18 | 12 21 | 16 10 | 8 4 |
| 9 | 7 15 | 14 26 | 10 31 | 1 42 | 3 40 | 1 5 | 4 55 | 5 21 | 2 39 | 12 38 | 16 6 | 7 37 |
| 10 | 7 40 | 14 27 | 10 15 | 1 26 | 3 43 | 0 53 | 5 3 | 5 13 | 3 0 | 12 54 | 16 0 | 7 10 |
| 11 | 8 4 | 14 27 | 9 59 | 1 9 | 3 46 | 0 41 | 5 12 | 5 4 | 3 20 | 13 10 | 15 54 | 6 43 |
| 12 | 8 27 | 14 27 | 9 43 | 0 53 | 3 47 | 0 29 | 5 19 | 4 54 | 3 41 | 13 25 | 15 47 | 6 15 |
| 13 | 8 50 | 14 26 | 9 26 | 0 37 | 3 49 | 0 17 | 5 27 | 4 44 | 4 2 | 13 39 | 15 39 | 5 47 |
| 14 | 9 12 | 14 24 | 9 9 | 0 22 | 3 49 | 0 5 | 5 34 | 4 33 | 4 24 | 13 54 | 15 30 | 5 18 |
| 15 | 9 34 | 14 21 | 8 52 | 0 7 | 3 49 | Add 0 8 | 5 40 | 4 22 | 4 45 | 14 7 | 15 21 | 4 49 |
| 16 | 9 55 | 14 18 | 8 34 | Sub. 0 8 | 3 49 | 0 21 | 5 46 | 4 10 | 5 6 | 14 20 | 15 10 | 4 20 |
| 17 | 10 15 | 14 14 | 8 17 | 0 23 | 3 48 | 0 33 | 5 52 | 3 58 | 5 27 | 14 33 | 14 59 | 3 51 |
| 18 | 10 34 | 14 9 | 7 59 | 0 37 | 3 46 | 0 46 | 5 57 | 3 45 | 5 48 | 14 44 | 14 46 | 3 21 |
| 19 | 10 53 | 14 3 | 7 41 | 0 50 | 3 44 | 0 59 | 6 1 | 3 32 | 6 10 | 14 56 | 14 33 | 2 52 |
| 20 | 11 11 | 13 57 | 7 23 | 1 3 | 3 41 | 1 12 | 6 5 | 3 18 | 6 31 | 15 6 | 14 19 | 2 22 |
| 21 | 11 28 | 13 50 | 7 5 | 1 16 | 3 38 | 1 25 | 6 8 | 3 4 | 6 52 | 15 16 | 14 5 | 1 52 |
| 22 | 11 45 | 13 43 | 6 46 | 1 28 | 3 34 | 1 38 | 6 11 | 2 49 | 7 13 | 15 25 | 13 49 | 1 22 |
| 23 | 12 1 | 13 35 | 6 28 | 1 40 | 3 30 | 1 51 | 6 14 | 2 34 | 7 33 | 15 34 | 13 33 | 0 51 |
| 24 | 12 16 | 13 26 | 6 10 | 1 52 | 3 25 | 2 4 | 6 15 | 2 18 | 7 54 | 15 42 | 13 15 | 0 21 |
| 25 | 12 30 | 13 17 | 5 51 | 2 3 | 3 19 | 2 17 | 6 17 | 2 2 | 8 15 | 15 49 | 12 57 | Add 0 9 |
| 26 | 12 43 | 13 7 | 5 33 | 2 13 | 3 13 | 2 30 | 6 17 | 1 46 | 8 35 | 15 55 | 12 39 | 0 39 |
| 27 | 12 56 | 12 57 | 5 15 | 2 23 | 3 7 | 2 42 | 6 17 | 1 29 | 8 55 | 16 1 | 12 19 | 1 8 |
| 28 | 13 8 | 12 46 | 4 56 | 2 32 | 3 0 | 2 55 | 6 17 | 1 12 | 9 15 | 16 6 | 11 59 | 1 38 |
| 29 | 13 19 | .. | 4 38 | 2 41 | 2 52 | 3 7 | 6 15 | 0 54 | 9 35 | 16 10 | 11 39 | 2 7 |
| 30 | 13 29 | .. | 4 20 | 2 49 | 2 44 | 3 19 | 6 14 | 0 37 | 9 55 | 16 14 | 11 17 | 2 37 |
| 31 | 13 38 | .. | .. | .. | 2 36 | .. | 6 11 | 0 18 | .. | 16 17 | .. | 3 5 |

## TABLE II.—(*continued*).

EQUATION OF TIME FOR THE YEARS 1901 AND 1905 FOR APPARENT NOON AT GREENWICH.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. |
| | Add | Add | Add | Add | Sub. | Sub. | Add | Add | Add | Sub. | Sub. | Sub. |
| 1 | 3 34 | 13 46 | 12 38 | 4 7 | 2 55 | 2 30 | 3 27 | 6 8 | 0 4 | 10 10 | 16 20 | 11 2 |
| 2 | 4 2 | 13 53 | 12 26 | 3 49 | 3 3 | 2 21 | 3 39 | 6 4 | Sub. 0 15 | 10 30 | 16 21 | 10 40 |
| 3 | 4 30 | 14 0 | 12 14 | 3 30 | 3 10 | 2 12 | 3 50 | 6 0 | 0 35 | 10 49 | 16 22 | 10 16 |
| 4 | 4 58 | 14 6 | 12 1 | 3 13 | 3 17 | 2 2 | 4 1 | 5 55 | 0 54 | 11 7 | 16 21 | 9 53 |
| 5 | 5 25 | 14 12 | 11 48 | 2 55 | 3 22 | 1 52 | 4 12 | 5 50 | 1 14 | 11 25 | 16 20 | 9 28 |
| 6 | 5 52 | 14 16 | 11 34 | 2 37 | 3 28 | 1 42 | 4 22 | 5 44 | 1 33 | 11 43 | 16 18 | 9 3 |
| 7 | 6 18 | 14 20 | 11 20 | 2 20 | 3 33 | 1 31 | 4 32 | 5 37 | 1 54 | 12 1 | 16 16 | 8 38 |
| 8 | 6 44 | 14 23 | 11 5 | 2 3 | 3 37 | 1 20 | 4 42 | 5 30 | 2 14 | 12 18 | 16 12 | 8 11 |
| 9 | 7 9 | 14 25 | 10 50 | 1 46 | 3 41 | 1 9 | 4 51 | 5 23 | 2 34 | 12 34 | 16 8 | 7 45 |
| 10 | 7 34 | 14 26 | 10 34 | 1 29 | 3 44 | 0 57 | 5 0 | 5 14 | 2 55 | 12 50 | 16 2 | 7 18 |
| 11 | 7 58 | 14 27 | 10 19 | 1 13 | 3 46 | 0 45 | 5 9 | 5 6 | 3 15 | 13 6 | 15 56 | 6 50 |
| 12 | 8 22 | 14 27 | 10 3 | 0 56 | 3 48 | 0 33 | 5 17 | 4 56 | 3 36 | 13 21 | 15 49 | 6 22 |
| 13 | 8 45 | 14 26 | 9 46 | 0 41 | 3 49 | 0 21 | 5 24 | 4 46 | 3 57 | 13 36 | 15 41 | 5 54 |
| 14 | 9 7 | 14 24 | 9 30 | 0 25 | 3 50 | 0 8 | 5 32 | 4 36 | 4 18 | 13 50 | 15 33 | 5 26 |
| 15 | 9 29 | 14 22 | 9 13 | 0 10 | 3 50 | Add 0 4 | 5 38 | 4 25 | 4 39 | 14 4 | 15 23 | 4 57 |
| 16 | 9 50 | 14 19 | 8 56 | Sub. 0 5 | 3 49 | 0 17 | 5 45 | 4 13 | 5 0 | 14 17 | 15 13 | 4 28 |
| 17 | 10 10 | 14 15 | 8 39 | 0 19 | 3 48 | 0 30 | 5 50 | 4 1 | 5 21 | 14 29 | 15 1 | 3 58 |
| 18 | 10 30 | 14 11 | 8 21 | 0 33 | 3 47 | 0 43 | 5 56 | 3 49 | 5 43 | 14 41 | 14 49 | 3 29 |
| 19 | 10 49 | 14 6 | 8 4 | 0 46 | 3 45 | 0 56 | 6 0 | 3 35 | 6 4 | 14 53 | 14 37 | 2 59 |
| 20 | 11 8 | 14 0 | 7 46 | 1 0 | 3 42 | 1 9 | 6 5 | 3 22 | 6 25 | 15 3 | 14 23 | 2 29 |
| 21 | 11 25 | 13 53 | 7 28 | 1 12 | 3 38 | 1 22 | 6 8 | 3 8 | 6 46 | 15 14 | 14 8 | 2 0 |
| 22 | 11 42 | 13 46 | 7 10 | 1 25 | 3 35 | 1 35 | 6 11 | 2 53 | 7 7 | 15 23 | 13 53 | 1 30 |
| 23 | 11 58 | 13 38 | 6 52 | 1 37 | 3 30 | 1 48 | 6 14 | 2 38 | 7 28 | 15 32 | 13 37 | 1 0 |
| 24 | 12 13 | 13 30 | 6 34 | 1 48 | 3 26 | 2 1 | 6 15 | 2 22 | 7 49 | 15 40 | 13 21 | 0 30 |
| 25 | 12 28 | 13 21 | 6 15 | 1 59 | 3 20 | 2 14 | 6 17 | 2 6 | 8 10 | 15 48 | 13 3 | 0 0 |
| 26 | 12 41 | 13 11 | 5 57 | 2 10 | 3 14 | 2 27 | 6 17 | 1 50 | 8 30 | 15 54 | 12 45 | Add 0 30 |
| 27 | 12 54 | 13 1 | 5 39 | 2 20 | 3 8 | 2 39 | 6 17 | 1 33 | 8 51 | 16 1 | 12 26 | 0 59 |
| 28 | 13 6 | 12 50 | 5 20 | 2 30 | 3 1 | 2 52 | 6 17 | 1 16 | 9 11 | 16 6 | 12 6 | 1 29 |
| 29 | 13 17 | .. | 5 2 | 2 39 | 2 54 | 3 4 | 6 15 | 0 58 | 9 31 | 16 11 | 11 45 | 1 58 |
| 30 | 13 28 | .. | 4 43 | 2 47 | 2 47 | 3 16 | 6 14 | 0 40 | 9 51 | 16 14 | 11 24 | 2 27 |
| 31 | 13 37 | .. | 4 25 | .. | 2 38 | .. | 6 11 | 0 22 | .. | 16 17 | .. | 2 56 |

## TABLE II.—(*continued*).

EQUATION OF TIME FOR THE YEARS 1902 and 1906 FOR APPARENT NOON AT GREENWICH.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. | m. s. |
| | Add | Add | Add | Add | Sub. | Sub. | Add | Add | Add | Sub. | Sub. | Sub. |
| 1 | 3 25 | 13 42 | 12 40 | 4 10 | 2 54 | 2 32 | 3 25 | 6 10 | 0 10 | 10 4 | 16 18 | 11 7 |
| | | | | | | | | | Sub. | | | |
| 2 | 3 54 | 13 50 | 12 28 | 3 52 | 3 2 | 2 23 | 3 37 | 6 7 | 0 9 | 10 23 | 16 19 | 10 45 |
| 3 | 4 22 | 13 57 | 12 16 | 3 34 | 3 9 | 2 14 | 3 49 | 6 3 | 0 28 | 10 42 | 16 20 | 10 22 |
| 4 | 4 49 | 14 4 | 12 3 | 3 16 | 3 15 | 2 4 | 4 0 | 5 58 | 0 47 | 11 1 | 16 20 | 9 58 |
| 5 | 5 17 | 14 9 | 11 50 | 2 59 | 3 21 | 1 54 | 4 11 | 5 53 | 1 7 | 11 19 | 16 19 | 9 34 |
| 6 | 5 44 | 14 14 | 11 36 | 2 41 | 3 26 | 1 43 | 4 21 | 5 48 | 1 26 | 11 37 | 16 18 | 9 9 |
| 7 | 6 10 | 14 18 | 11 22 | 2 24 | 3 31 | 1 32 | 4 32 | 5 41 | 1 46 | 11 54 | 16 15 | 8 43 |
| 8 | 6 36 | 14 22 | 11 8 | 2 7 | 3 35 | 1 21 | 4 42 | 5 34 | 2 7 | 12 12 | 16 12 | 8 17 |
| 9 | 7 2 | 14 24 | 10 53 | 1 50 | 3 39 | 1 10 | 4 51 | 5 27 | 2 27 | 12 28 | 16 8 | 7 51 |
| 10 | 7 27 | 14 26 | 10 38 | 1 33 | 3 42 | 0 58 | 5 0 | 5 19 | 2 48 | 12 45 | 16 3 | 7 24 |
| 11 | 7 51 | 14 27 | 10 22 | 1 17 | 3 44 | 0 46 | 5 9 | 5 10 | 3 8 | 13 1 | 15 57 | 6 57 |
| 12 | 8 15 | 14 27 | 10 7 | 1 1 | 3 46 | 0 34 | 5 17 | 5 1 | 3 29 | 13 16 | 15 50 | 6 30 |
| 13 | 8 39 | 14 26 | 9 50 | 0 45 | 3 48 | 0 22 | 5 25 | 4 51 | 3 50 | 13 31 | 15 43 | 6 2 |
| 14 | 9 1 | 14 25 | 9 34 | 0 30 | 3 49 | 0 10 | 5 32 | 4 40 | 4 11 | 13 45 | 15 34 | 5 33 |
| | | | | | | Add | | | | | | |
| 15 | 9 23 | 14 22 | 9 17 | 0 14 | 3 49 | 0 3 | 5 39 | 4 29 | 4 33 | 13 59 | 15 25 | 5 5 |
| | | | | Sub. | | | | | | | | |
| 16 | 9 44 | 14 19 | 9 0 | 0 0 | 3 49 | 0 15 | 5 45 | 4 18 | 4 54 | 14 13 | 15 15 | 4 36 |
| 17 | 10 5 | 14 16 | 8 43 | 0 15 | 3 48 | 0 28 | 5 51 | 4 6 | 5 15 | 14 26 | 15 5 | 4 7 |
| 18 | 10 25 | 14 11 | 8 26 | 0 29 | 3 46 | 0 41 | 5 56 | 3 53 | 5 37 | 14 38 | 14 53 | 3 38 |
| 19 | 10 44 | 14 6 | 8 8 | 0 43 | 3 44 | 0 54 | 6 0 | 3 40 | 5 58 | 14 50 | 14 40 | 3 8 |
| 20 | 11 2 | 14 0 | 7 50 | 0 56 | 3 42 | 1 7 | 6 5 | 3 26 | 6 19 | 15 1 | 14 27 | 2 38 |
| 21 | 11 20 | 13 54 | 7 32 | 1 9 | 3 39 | 1 20 | 6 8 | 3 12 | 6 40 | 15 11 | 14 13 | 2 8 |
| 22 | 11 37 | 13 47 | 7 14 | 1 22 | 3 35 | 1 33 | 6 11 | 2 57 | 7 1 | 15 21 | 13 58 | 1 39 |
| 23 | 11 53 | 13 39 | 6 56 | 1 34 | 3 31 | 1 46 | 6 14 | 2 42 | 7 22 | 15 30 | 13 42 | 1 9 |
| 24 | 12 8 | 13 30 | 6 37 | 1 46 | 3 27 | 1 58 | 6 16 | 2 27 | 7 43 | 15 38 | 13 25 | 0 39 |
| 25 | 12 23 | 13 21 | 6 19 | 1 57 | 3 22 | 2 11 | 6 17 | 2 11 | 8 4 | 15 46 | 13 8 | 0 9 |
| | | | | | | | | | | | | Add |
| 26 | 12 36 | 13 12 | 6 0 | 2 8 | 3 16 | 2 24 | 6 18 | 1 55 | 8 25 | 15 52 | 12 49 | 0 21 |
| 27 | 12 49 | 13 2 | 5 42 | 2 18 | 3 10 | 2 37 | 6 18 | 1 38 | 8 45 | 15 59 | 12 30 | 0 51 |
| 28 | 13 1 | 12 51 | 5 23 | 2 28 | 3 3 | 2 49 | 6 18 | 1 21 | 9 5 | 16 4 | 12 11 | 1 21 |
| 29 | 13 13 | .. | 5 5 | 2 37 | 2 56 | 3 1 | 6 17 | 1 4 | 9 25 | 16 9 | 11 50 | 1 50 |
| 30 | 13 23 | .. | 4 47 | 2 46 | 2 48 | 3 13 | 6 15 | 0 46 | 9 45 | 16 13 | 11 29 | 2 20 |
| 31 | 13 33 | .. | 4 28 | .. | 2 40 | .. | 6 13 | 0 28 | .. | 16 16 | .. | 2 49 |

## TABLE III.

RIGHT ASCENSION OF THE SUN AT APPARENT NOON AT GREENWICH FOR THE YEARS 1899 AND 1903.

| Day 1899. | Day 1903. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. |
| 1 | 2 | 18 47 29 | 20 59 45 | 22 48 51 | 0 42 28 | 2 33 47 | 4 36 35 | 6 40 51 | 8 45 39 | 10 41 39 | 12 29 39 | 14 25 51 | 16 29 38 |
| 2 | 3 | 18 51 53 | 21 3 49 | 22 52 35 | 0 46 7 | 2 37 37 | 4 40 40 | 6 45 0 | 8 49 31 | 10 45 16 | 12 33 17 | 14 29 47 | 16 33 58 |
| 3 | 4 | 18 56 18 | 21 7 52 | 22 56 19 | 0 49 45 | 2 41 26 | 4 44 47 | 6 49 7 | 8 53 23 | 10 48 54 | 12 36 55 | 14 33 43 | 16 38 18 |
| 4 | 5 | 19 0 42 | 21 11 54 | 23 0 3 | 0 53 24 | 2 45 17 | 4 48 53 | 6 53 15 | 8 57 15 | 10 52 31 | 12 40 33 | 14 37 41 | 16 42 39 |
| 5 | 6 | 19 5 6 | 21 15 56 | 23 3 46 | 0 57 3 | 2 49 8 | 4 53 0 | 6 57 22 | 9 1 6 | 10 56 8 | 12 44 12 | 14 41 39 | 16 47 0 |
| 6 | 7 | 19 9 29 | 21 19 57 | 23 7 28 | 1 0 42 | 2 52 59 | 4 57 7 | 7 1 29 | 9 4 56 | 10 59 44 | 12 47 51 | 14 45 38 | 16 51 22 |
| 7 | 8 | 19 13 52 | 21 23 57 | 23 11 11 | 1 4 22 | 2 56 52 | 5 1 15 | 7 5 36 | 9 8 46 | 11 3 21 | 12 51 30 | 14 49 37 | 16 55 45 |
| 8 | 9 | 19 18 14 | 21 27 56 | 23 14 52 | 1 8 1 | 3 0 44 | 5 5 23 | 7 9 42 | 9 12 35 | 11 6 57 | 12 55 10 | 14 53 38 | 17 0 8 |
| 9 | 10 | 19 22 36 | 21 31 55 | 23 18 34 | 1 11 41 | 3 4 38 | 5 9 31 | 7 13 48 | 9 16 24 | 11 10 33 | 12 58 50 | 14 57 39 | 17 4 31 |
| 10 | 11 | 19 26 57 | 21 35 52 | 23 22 15 | 1 15 21 | 3 8 32 | 5 13 39 | 7 17 53 | 9 20 12 | 11 14 9 | 13 2 30 | 15 1 42 | 17 8 55 |
| 11 | 12 | 19 31 18 | 21 39 49 | 23 25 56 | 1 19 1 | 3 12 26 | 5 17 48 | 7 21 58 | 9 23 59 | 11 17 44 | 13 6 11 | 15 5 45 | 17 13 19 |
| 12 | 13 | 19 35 58 | 21 43 45 | 23 29 36 | 1 22 42 | 3 16 21 | 5 21 57 | 7 26 2 | 9 27 46 | 11 21 20 | 13 9 53 | 15 9 49 | 17 17 44 |
| 13 | 14 | 19 39 57 | 21 47 41 | 23 33 16 | 1 26 23 | 3 20 17 | 5 26 6 | 7 30 6 | 9 31 32 | 11 24 55 | 13 13 35 | 15 13 53 | 17 22 9 |
| 14 | 15 | 19 44 16 | 21 51 35 | 23 36 56 | 1 30 4 | 3 24 13 | 5 30 15 | 7 34 10 | 9 35 18 | 11 28 31 | 13 17 17 | 15 17 59 | 17 26 34 |
| 15 | 16 | 19 48 34 | 21 55 29 | 23 40 36 | 1 33 46 | 3 28 10 | 5 34 24 | 7 38 13 | 9 39 3 | 11 32 6 | 13 21 0 | 15 22 5 | 17 30 59 |
| 16 | 17 | 19 52 51 | 21 59 22 | 23 44 15 | 1 37 28 | 3 32 7 | 5 38 34 | 7 42 15 | 9 42 48 | 11 35 41 | 13 24 44 | 15 26 13 | 17 35 25 |
| 17 | 18 | 19 57 8 | 22 3 14 | 23 47 54 | 1 41 10 | 3 36 5 | 5 42 43 | 7 46 17 | 9 46 32 | 11 39 16 | 13 28 28 | 15 30 21 | 17 39 51 |
| 18 | 19 | 20 1 24 | 22 7 6 | 23 51 33 | 1 44 53 | 3 40 3 | 5 46 53 | 7 50 19 | 9 50 15 | 11 42 52 | 13 32 13 | 15 34 29 | 17 44 17 |
| 19 | 20 | 20 5 39 | 22 10 57 | 23 55 12 | 1 48 36 | 3 44 2 | 5 51 2 | 7 54 20 | 9 53 59 | 11 46 27 | 13 35 58 | 15 38 39 | 17 48 43 |
| 20 | 21 | 20 9 54 | 22 14 47 | 23 58 51 | 1 52 19 | 3 48 2 | 5 55 12 | 7 58 20 | 9 57 41 | 11 50 2 | 13 39 44 | 15 42 50 | 17 53 10 |
| 21 | 22 | 20 14 7 | 22 18 37 | 0 2 29 | 1 56 3 | 3 52 2 | 5 59 21 | 8 2 20 | 10 1 23 | 11 53 37 | 13 43 31 | 15 47 1 | 17 57 36 |
| 22 | 23 | 20 18 20 | 22 22 26 | 0 6 7 | 1 59 47 | 3 56 2 | 6 3 31 | 8 6 19 | 10 5 5 | 11 57 13 | 13 47 18 | 15 51 13 | 18 2 3 |
| 23 | 24 | 20 22 32 | 22 26 14 | 0 9 45 | 2 3 32 | 4 0 3 | 6 7 40 | 8 10 17 | 10 8 46 | 12 0 48 | 13 51 6 | 15 55 26 | 18 6 29 |
| 24 | 25 | 20 26 44 | 22 30 2 | 0 13 24 | 2 7 17 | 4 4 5 | 6 11 50 | 8 14 15 | 10 12 26 | 12 4 24 | 13 54 55 | 15 59 40 | 18 10 56 |
| 25 | 26 | 20 30 54 | 22 33 49 | 0 17 2 | 2 11 3 | 4 8 7 | 6 15 59 | 8 18 13 | 10 16 7 | 12 8 0 | 13 58 44 | 16 3 55 | 18 15 22 |
| 26 | 27 | 20 35 4 | 22 37 35 | 0 20 40 | 2 14 49 | 4 12 9 | 6 20 8 | 8 22 10 | 10 19 47 | 12 11 36 | 14 2 34 | 16 8 10 | 18 19 49 |
| 27 | 28 | 20 39 13 | 22 41 21 | 0 24 18 | 2 18 36 | 4 16 12 | 6 24 17 | 8 26 6 | 10 23 26 | 12 15 12 | 14 6 25 | 16 12 26 | 18 24 15 |
| 28 | 29 | 20 43 21 | 22 45 6 | 0 27 56 | 2 22 23 | 4 20 16 | 6 28 26 | 8 30 2 | 10 27 5 | 12 18 49 | 14 10 17 | 16 16 43 | 18 28 41 |
| 29 | 30 | 20 47 28 | .. | 0 31 34 | 2 26 10 | 4 24 20 | 6 32 35 | 8 33 57 | 10 30 44 | 12 22 25 | 14 14 9 | 16 21 1 | 18 33 8 |
| 30 | 31 | 20 51 34 | .. | 0 35 12 | 2 29 59 | 4 28 24 | 6 36 43 | 8 37 51 | 10 34 23 | 12 26 2 | 14 18 2 | 16 25 19 | 18 37 33 |
| 31 | .. | 29 55 40 | .. | 0 38 50 | .. | 4 32 29 | .. | 8 41 45 | 10 38 1 | .. | 14 21 57 | .. | 18 41 59 |

## TABLE III.—(*continued*).

RIGHT ASCENSION OF THE SUN AT APPARENT NOON AT GREENWICH * FOR THE YEARS 1900 AND 1904.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. |
| 1 | 18 46 24 | 20 58 46 | 22 47 57 | 0 41 36 | 2 32 52 | 4 35 36 | 6 39 52 | 8 44 42 | 10 40 46 | 12 28 47 | 14 24 55 | 16 28 36 |
| 2 | 18 50 49 | 21 2 50 | 22 51 42 | 0 45 15 | 2 36 42 | 4 39 41 | 6 44 0 | 8 48 35 | 10 44 24 | 12 32 25 | 14 28 50 | 16 32 55 |
| 3 | 18 55 14 | 21 6 54 | 22 55 26 | 0 48 53 | 2 40 31 | 4 43 48 | 6 48 8 | 8 52 27 | 10 48 1 | 12 36 2 | 14 32 46 | 16 37 15 |
| 4 | 18 59 38 | 21 10 56 | 22 59 9 | 0 52 32 | 2 44 22 | 4 47 54 | 6 52 15 | 8 56 19 | 10 51 38 | 12 39 40 | 14 36 43 | 16 41 36 |
| 5 | 19 4 2 | 21 14 58 | 23 2 53 | 0 56 11 | 2 48 13 | 4 52 1 | 6 56 23 | 9 0 10 | 10 55 15 | 12 43 19 | 14 40 41 | 16 45 57 |
| 6 | 19 8 25 | 21 18 59 | 23 6 35 | 0 59 50 | 2 52 4 | 4 56 8 | 7 0 29 | 9 4 0 | 10 58 51 | 12 46 57 | 14 44 39 | 16 50 19 |
| 7 | 19 12 48 | 21 22 59 | 23 10 18 | 1 3 29 | 2 55 56 | 5 0 15 | 7 4 36 | 9 7 50 | 11 2 28 | 12 50 36 | 14 48 39 | 16 54 41 |
| 8 | 19 17 11 | 21 26 59 | 23 13 59 | 1 7 9 | 2 59 48 | 5 4 23 | 7 8 42 | 9 11 39 | 11 6 4 | 12 54 16 | 14 52 39 | 16 59 3 |
| 9 | 19 21 33 | 21 30 57 | 23 17 41 | 1 10 48 | 3 3 42 | 5 8 31 | 7 12 48 | 9 15 28 | 11 9 40 | 12 57 56 | 14 56 40 | 17 3 27 |
| 10 | 19 25 54 | 21 34 55 | 23 21 22 | 1 14 28 | 3 7 35 | 5 12 39 | 7 16 53 | 9 19 16 | 11 13 15 | 13 1 36 | 15 0 42 | 17 7 50 |
| 11 | 19 30 14 | 21 38 52 | 23 25 3 | 1 18 8 | 3 11 29 | 5 16 47 | 7 20 58 | 9 23 3 | 11 16 51 | 13 5 17 | 15 4 45 | 17 12 14 |
| 12 | 19 34 34 | 21 42 48 | 23 28 43 | 1 21 49 | 3 15 24 | 5 20 56 | 7 25 2 | 9 26 50 | 11 20 26 | 13 8 58 | 15 8 49 | 17 16 39 |
| 13 | 19 38 54 | 21 46 43 | 23 32 23 | 1 25 29 | 3 19 19 | 5 25 5 | 7 29 6 | 9 30 37 | 11 24 2 | 13 12 40 | 15 12 53 | 17 21 4 |
| 14 | 19 43 13 | 21 50 38 | 23 36 3 | 1 29 10 | 3 23 15 | 5 29 14 | 7 33 10 | 9 34 22 | 11 27 37 | 13 16 22 | 15 16 58 | 17 25 29 |
| 15 | 19 47 31 | 21 54 32 | 23 39 42 | 1 32 52 | 3 27 12 | 5 33 23 | 7 37 13 | 9 38 8 | 11 31 13 | 13 20 5 | 15 21 5 | 17 29 54 |
| 16 | 19 51 48 | 21 58 25 | 23 43 22 | 1 36 34 | 3 31 9 | 5 37 32 | 7 41 15 | 9 41 52 | 11 34 48 | 13 23 49 | 15 25 12 | 17 34 20 |
| 17 | 19 56 5 | 22 2 18 | 23 47 1 | 1 40 16 | 3 35 6 | 5 41 42 | 7 45 18 | 9 45 36 | 11 38 23 | 13 27 33 | 15 29 20 | 17 38 46 |
| 18 | 20 0 21 | 22 6 9 | 23 50 40 | 1 43 58 | 3 39 5 | 5 45 51 | 7 49 19 | 9 49 20 | 11 41 58 | 13 31 18 | 15 33 29 | 17 43 12 |
| 19 | 20 4 36 | 22 10 0 | 23 54 18 | 1 47 41 | 3 43 3 | 5 50 1 | 7 53 20 | 9 53 3 | 11 45 34 | 13 35 3 | 15 37 38 | 17 47 39 |
| 20 | 20 8 51 | 22 13 51 | 23 57 57 | 1 51 24 | 3 47 3 | 5 54 10 | 7 57 21 | 9 56 46 | 11 49 9 | 13 38 49 | 15 41 49 | 17 52 5 |
| 21 | 20 13 5 | 22 17 40 | 0 1 35 | 1 55 8 | 3 51 3 | 5 58 20 | 8 1 21 | 10 0 28 | 11 52 45 | 13 42 35 | 15 46 0 | 17 56 32 |
| 22 | 20 17 18 | 22 21 30 | 0 5 14 | 1 58 52 | 3 55 3 | 6 2 29 | 8 5 20 | 10 4 10 | 11 56 20 | 13 46 23 | 15 50 13 | 18 0 59 |
| 23 | 20 21 30 | 22 25 18 | 0 8 52 | 2 2 37 | 3 59 4 | 6 6 39 | 8 9 19 | 10 7 52 | 11 59 56 | 13 50 11 | 15 54 26 | 18 5 26 |
| 24 | 20 25 42 | 22 29 6 | 0 12 30 | 2 6 22 | 4 3 6 | 6 10 49 | 8 13 17 | 10 11 33 | 12 3 32 | 13 53 59 | 15 58 39 | 18 9 52 |
| 25 | 20 29 53 | 22 32 53 | 0 16 8 | 2 10 8 | 4 7 8 | 6 14 58 | 8 17 15 | 10 15 13 | 12 7 8 | 13 57 49 | 16 2 54 | 18 14 19 |
| 26 | 20 34 3 | 22 36 40 | 0 19 46 | 2 13 54 | 4 11 10 | 6 19 7 | 8 21 12 | 10 18 53 | 12 10 44 | 14 1 39 | 16 7 9 | 18 18 45 |
| 27 | 20 38 12 | 22 40 26 | 0 23 25 | 2 17 41 | 4 15 13 | 6 23 17 | 8 25 9 | 10 22 33 | 12 14 20 | 14 5 30 | 16 11 25 | 18 23 12 |
| 28 | 20 42 20 | 22 44 12 | 0 27 3 | 2 21 28 | 4 19 17 | 6 27 26 | 8 29 5 | 10 26 12 | 12 17 56 | 14 9 21 | 16 15 42 | 18 27 38 |
| 29 | 20 46 28 | .. | 0 30 41 | 2 25 15 | 4 23 21 | 6 31 35 | 8 33 0 | 10 29 51 | 12 21 33 | 14 13 13 | 16 19 59 | 18 32 4 |
| 30 | 20 50 35 | .. | 0 34 19 | 2 29 4 | 4 27 25 | 6 35 43 | 8 36 55 | 10 33 30 | 12 25 10 | 14 17 6 | 16 24 17 | 18 36 30 |
| 31 | 20 54 41 | .. | 0 37 58 | .. | 4 31 30 | .. | 8 40 49 | 10 37 8 | .. | 14 21 0 | .. | 18 40 56 |

* To find Sidereal Time at Mean Noon, see explanation of Table III. (p. 219).

## TABLE III.—(*continued*).

### Right Ascension of the Sun at Apparent Noon at Greenwich for the Years 1901 and 1905.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. |
| 1 | 18 45 21 | 20 57 47 | 22 47 3 | 0 40 43 | 2 31 57 | 4 34 35 | 6 38 51 | 8 43 45 | 10 39 52 | 12 27 53 | 14 23 56 | 16 27 31 |
| 2 | 18 49 46 | 21 1 52 | 22 50 48 | 0 44 22 | 2 35 46 | 4 38 41 | 6 42 59 | 8 47 38 | 10 43 30 | 12 31 31 | 14 27 51 | 16 31 50 |
| 3 | 18 54 10 | 21 5 55 | 22 54 32 | 0 48 0 | 2 39 35 | 4 42 47 | 6 47 6 | 8 51 30 | 10 47 7 | 12 35 8 | 14 31 47 | 16 36 10 |
| 4 | 18 58 34 | 21 9 58 | 22 58 15 | 0 51 39 | 2 43 25 | 4 46 53 | 6 51 14 | 8 55 22 | 10 50 44 | 12 38 46 | 14 35 44 | 16 40 31 |
| 5 | 19 2 58 | 21 14 0 | 23 1 59 | 0 55 17 | 2 47 16 | 4 51 0 | 6 55 21 | 8 59 13 | 10 54 21 | 12 42 24 | 14 39 42 | 16 44 52 |
| 6 | 19 7 21 | 21 18 1 | 23 5 41 | 0 58 56 | 2 51 7 | 4 55 6 | 6 59 28 | 9 3 3 | 10 57 58 | 12 46 3 | 14 43 40 | 16 49 13 |
| 7 | 19 11 44 | 21 22 1 | 23 9 24 | 1 2 35 | 2 54 59 | 4 59 14 | 7 3 35 | 9 6 53 | 11 1 34 | 12 49 42 | 14 47 40 | 16 53 36 |
| 8 | 19 16 7 | 21 26 1 | 23 13 5 | 1 6 15 | 2 58 51 | 5 3 21 | 7 7 41 | 9 10 43 | 11 5 11 | 12 53 22 | 14 51 40 | 16 57 58 |
| 9 | 19 20 29 | 21 29 59 | 23 16 47 | 1 9 54 | 3 2 44 | 5 7 29 | 7 11 47 | 9 14 32 | 11 8 47 | 12 57 2 | 14 55 41 | 17 2 22 |
| 10 | 19 24 50 | 21 33 57 | 23 20 28 | 1 13 34 | 3 6 37 | 5 11 37 | 7 15 52 | 9 18 20 | 11 12 23 | 13 0 42 | 14 59 43 | 17 6 45 |
| 11 | 19 29 11 | 21 37 54 | 23 24 9 | 1 17 14 | 3 10 31 | 5 15 46 | 7 19 58 | 9 22 8 | 11 15 58 | 13 4 23 | 15 3 45 | 17 11 9 |
| 12 | 19 33 31 | 21 41 51 | 23 27 49 | 1 20 55 | 3 14 26 | 5 19 55 | 7 24 2 | 9 25 55 | 11 19 34 | 13 8 4 | 15 7 49 | 17 15 34 |
| 13 | 19 37 51 | 21 45 46 | 23 31 29 | 1 24 35 | 3 18 21 | 5 24 4 | 7 28 6 | 9 29 41 | 11 23 10 | 13 11 46 | 15 11 53 | 17 19 59 |
| 14 | 19 42 10 | 21 49 41 | 23 35 9 | 1 28 16 | 3 22 17 | 5 28 13 | 7 32 10 | 9 33 27 | 11 26 45 | 13 15 28 | 15 15 59 | 17 24 24 |
| 15 | 19 46 28 | 21 53 35 | 23 38 49 | 1 31 58 | 3 26 14 | 5 32 22 | 7 36 14 | 9 37 13 | 11 30 21 | 13 19 11 | 15 20 5 | 17 28 49 |
| 16 | 19 50 46 | 21 57 29 | 23 42 29 | 1 35 40 | 3 30 11 | 5 36 31 | 7 40 16 | 9 40 58 | 11 33 56 | 13 22 55 | 15 24 12 | 17 33 15 |
| 17 | 19 55 3 | 22 1 22 | 23 46 8 | 1 39 22 | 3 34 8 | 5 40 41 | 7 44 19 | 9 44 42 | 11 37 31 | 13 26 39 | 15 28 20 | 17 37 41 |
| 18 | 19 59 19 | 22 5 14 | 23 49 47 | 1 43 4 | 3 38 7 | 5 44 50 | 7 48 21 | 9 48 26 | 11 41 7 | 13 30 23 | 15 32 28 | 17 42 7 |
| 19 | 20 3 35 | 22 9 5 | 23 53 26 | 1 46 47 | 3 42 5 | 5 49 0 | 7 52 22 | 9 52 10 | 11 44 42 | 13 34 8 | 15 36 38 | 17 46 34 |
| 20 | 20 7 50 | 22 12 56 | 23 57 5 | 1 50 31 | 3 46 5 | 5 53 10 | 7 56 23 | 9 55 53 | 11 48 17 | 13 37 54 | 15 40 48 | 17 51 0 |
| 21 | 20 12 4 | 22 16 46 | 0 0 43 | 1 54 14 | 3 50 5 | 5 57 19 | 8 0 23 | 9 59 35 | 11 51 53 | 13 41 40 | 15 44 59 | 17 55 26 |
| 22 | 20 16 18 | 22 20 35 | 0 4 22 | 1 57 59 | 3 54 5 | 6 1 29 | 8 4 22 | 10 3 17 | 11 55 28 | 13 45 27 | 15 49 11 | 17 59 53 |
| 23 | 20 20 30 | 22 24 24 | 0 8 0 | 2 1 43 | 3 58 6 | 6 5 39 | 8 8 21 | 10 6 58 | 11 59 4 | 13 49 15 | 15 53 23 | 18 4 19 |
| 24 | 20 24 42 | 22 28 12 | 0 11 38 | 2 5 28 | 4 2 7 | 6 9 48 | 8 12 20 | 10 10 39 | 12 2 39 | 13 53 3 | 15 57 37 | 18 8 46 |
| 25 | 20 28 53 | 22 31 59 | 0 15 16 | 2 9 14 | 4 6 9 | 6 13 58 | 8 16 17 | 10 14 20 | 12 6 15 | 13 56 52 | 16 1 51 | 18 13 12 |
| 26 | 20 33 3 | 22 35 46 | 0 18 55 | 2 13 0 | 4 10 11 | 6 18 7 | 8 20 15 | 10 18 0 | 12 9 51 | 14 0 42 | 16 6 6 | 18 17 39 |
| 27 | 20 37 13 | 22 39 32 | 0 22 33 | 2 16 46 | 4 14 14 | 6 22 16 | 8 24 11 | 10 21 40 | 12 13 27 | 14 4 33 | 16 10 21 | 18 22 5 |
| 28 | 20 41 21 | 22 43 18 | 0 26 11 | 2 20 33 | 4 18 18 | 6 26 25 | 8 28 7 | 10 25 19 | 12 17 3 | 14 8 24 | 16 14 38 | 18 26 31 |
| 29 | 20 45 29 | .. | 0 29 49 | 2 24 20 | 4 22 21 | 6 30 34 | 8 32 2 | 10 28 58 | 12 20 40 | 14 12 16 | 16 18 55 | 18 30 57 |
| 30 | 20 49 36 | .. | 0 33 27 | 2 28 8 | 4 26 26 | 6 34 42 | 8 35 57 | 10 32 36 | 12 24 16 | 14 16 8 | 16 23 13 | 18 35 23 |
| 31 | 20 53 42 | .. | 0 37 5 | .. | 4 30 30 | .. | 8 39 51 | 10 36 15 | .. | 14 20 2 | .. | 18 39 49 |

## TABLE III.—(*continued*).

RIGHT ASCENSION OF THE SUN AT APPARENT NOON AT GREENWICH FOR THE YEARS 1902 AND 1906.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. | h. m. s. |
| 1 | 18 44 14 | 20 56 46 | 22 46 7 | 0 39 49 | 2 31 1 | 4 33 36 | 6 37 51 | 8 42 49 | 10 39 1 | 12 27 2 | 14 23 0 | 16 26 29 |
| 2 | 18 48 39 | 21 0 50 | 22 49 52 | 0 43 28 | 2 34 50 | 4 37 41 | 6 41 59 | 8 46 43 | 10 42 39 | 12 30 39 | 14 26 55 | 16 30 48 |
| 3 | 18 53 4 | 21 4 54 | 22 53 36 | 0 47 6 | 2 38 39 | 4 41 47 | 6 46 7 | 8 50 35 | 10 46 16 | 12 34 17 | 14 30 51 | 16 35 7 |
| 4 | 18 57 28 | 21 8 57 | 22 57 20 | 0 50 45 | 2 42 29 | 4 45 54 | 6 50 15 | 8 54 27 | 10 49 54 | 12 37 55 | 14 34 48 | 16 39 28 |
| 5 | 19 1 52 | 21 13 0 | 23 1 3 | 0 54 24 | 2 46 20 | 4 50 0 | 6 54 23 | 8 58 19 | 10 53 31 | 12 41 33 | 14 38 45 | 16 43 49 |
| 6 | 19 6 16 | 21 17 1 | 23 4 46 | 0 58 3 | 2 50 11 | 4 54 8 | 6 58 30 | 9 2 9 | 10 57 7 | 12 45 12 | 14 42 43 | 16 48 10 |
| 7 | 19 10 39 | 21 21 2 | 23 8 29 | 1 1 42 | 2 54 3 | 4 58 15 | 7 2 37 | 9 6 0 | 11 0 44 | 12 48 51 | 14 46 43 | 16 52 32 |
| 8 | 19 15 2 | 21 25 2 | 23 12 11 | 1 5 21 | 2 57 55 | 5 2 23 | 7 6 43 | 9 9 49 | 11 4 20 | 12 52 30 | 14 50 42 | 16 56 55 |
| 9 | 19 19 24 | 21 29 1 | 23 15 52 | 1 9 1 | 3 1 48 | 5 6 31 | 7 10 49 | 9 13 38 | 11 7 56 | 12 56 10 | 14 54 43 | 17 1 18 |
| 10 | 19 23 46 | 21 32 59 | 23 19 34 | 1 12 41 | 3 5 41 | 5 10 39 | 7 14 55 | 9 17 27 | 11 11 32 | 12 59 50 | 14 58 45 | 17 5 41 |
| 11 | 19 28 7 | 21 36 56 | 23 23 15 | 1 16 21 | 3 9 36 | 5 14 47 | 7 19 0 | 9 21 14 | 11 15 8 | 13 3 31 | 15 2 47 | 17 10 5 |
| 12 | 19 32 27 | 21 40 53 | 23 26 56 | 1 20 2 | 3 13 30 | 5 18 56 | 7 23 5 | 9 25 2 | 11 18 43 | 13 7 12 | 15 6 50 | 17 14 29 |
| 13 | 19 36 47 | 21 44 49 | 23 30 36 | 1 23 42 | 3 17 25 | 5 23 5 | 7 27 9 | 9 28 48 | 11 22 19 | 13 10 53 | 15 10 54 | 17 18 54 |
| 14 | 19 41 6 | 21 48 44 | 23 34 16 | 1 27 23 | 3 21 21 | 5 27 14 | 7 31 13 | 9 32 34 | 11 25 54 | 13 14 35 | 15 14 59 | 17 23 19 |
| 15 | 19 45 25 | 21 52 38 | 23 37 56 | 1 31 5 | 3 25 17 | 5 31 23 | 7 35 16 | 9 36 20 | 11 29 30 | 13 18 18 | 15 19 5 | 17 27 44 |
| 16 | 19 49 43 | 21 56 32 | 23 41 35 | 1 34 46 | 3 29 14 | 5 35 32 | 7 39 19 | 9 40 5 | 11 33 5 | 13 22 1 | 15 23 11 | 17 32 9 |
| 17 | 19 54 0 | 22 0 25 | 23 45 15 | 1 38 28 | 3 33 12 | 5 39 41 | 7 43 21 | 9 43 49 | 11 36 40 | 13 25 45 | 15 27 19 | 17 36 35 |
| 18 | 19 58 17 | 22 4 17 | 23 48 54 | 1 42 11 | 3 37 9 | 5 43 51 | 7 47 23 | 9 47 33 | 11 40 15 | 13 29 29 | 15 31 27 | 17 41 1 |
| 19 | 20 2 32 | 22 8 8 | 23 52 32 | 1 45 53 | 3 41 8 | 5 48 0 | 7 51 24 | 9 51 16 | 11 43 50 | 13 33 14 | 15 35 36 | 17 45 27 |
| 20 | 20 6 47 | 22 11 59 | 23 56 11 | 1 49 36 | 3 45 7 | 5 52 10 | 7 55 25 | 9 54 59 | 11 47 26 | 13 36 59 | 15 39 46 | 17 49 53 |
| 21 | 20 11 1 | 22 15 49 | 23 59 50 | 1 53 20 | 3 49 7 | 5 56 19 | 7 59 25 | 9 58 42 | 11 51 1 | 13 40 45 | 15 43 57 | 17 54 20 |
| 22 | 20 15 15 | 22 19 38 | 0 3 28 | 1 57 4 | 3 53 7 | 6 0 29 | 8 3 25 | 10 2 24 | 11 54 36 | 13 44 32 | 15 48 9 | 17 58 46 |
| 23 | 20 19 28 | 22 23 27 | 0 7 6 | 2 0 48 | 3 57 7 | 6 4 38 | 8 7 24 | 10 6 5 | 11 58 12 | 13 48 20 | 15 52 21 | 18 3 13 |
| 24 | 20 23 39 | 22 27 15 | 0 10 44 | 2 4 33 | 4 1 8 | 6 8 48 | 8 11 22 | 10 9 46 | 12 1 47 | 13 52 8 | 15 56 34 | 18 7 40 |
| 25 | 20 27 51 | 22 31 3 | 0 14 22 | 2 8 18 | 4 5 10 | 6 12 57 | 8 15 20 | 10 13 27 | 12 5 23 | 13 55 57 | 16 0 48 | 18 12 6 |
| 26 | 20 32 1 | 22 34 49 | 0 18 0 | 2 12 4 | 4 9 12 | 6 17 6 | 8 19 18 | 10 17 7 | 12 8 59 | 13 59 47 | 16 5 3 | 18 16 33 |
| 27 | 20 36 10 | 22 38 36 | 0 21 38 | 2 15 50 | 4 13 15 | 6 21 16 | 8 23 14 | 10 20 47 | 12 12 35 | 14 3 37 | 16 9 19 | 18 20 59 |
| 28 | 20 40 19 | 22 42 22 | 0 25 17 | 2 19 37 | 4 17 18 | 6 25 25 | 8 27 10 | 10 24 26 | 12 16 12 | 14 7 28 | 16 13 35 | 18 25 26 |
| 29 | 20 44 27 | .. | 0 28 55 | 2 23 24 | 4 21 22 | 6 29 34 | 8 31 6 | 10 28 6 | 12 19 48 | 14 11 20 | 16 17 52 | 18 29 52 |
| 30 | 20 48 34 | .. | 0 32 33 | 2 27 12 | 4 25 26 | 6 33 42 | 8 35 1 | 10 31 44 | 12 23 25 | 14 15 13 | 16 22 10 | 18 34 18 |
| 31 | 20 52 40 | .. | 0 36 11 | .. | 4 29 31 | .. | 8 38 55 | 10 35 23 | .. | 14 19 6 | .. | 18 38 44 |

## TABLE IV.

### Mean Places of 50 of the Principal Fixed Stars* for January 1st, 1901.

| Name. | Mag. | Right Asc. | Ann. Var. | Declination. | Ann. Var. |
|---|---|---|---|---|---|
| | | h. m. s. | | ° ′ ″ | ″ |
| α Andromedæ .. .. .. .. .. | 2·1 | 0 3 16·12 | +3·08 | +28 32 37·89 | +20·04 |
| γ Pegasi (*Algenib*) .. .. .. .. | 3·0 | 0 8 8·22 | 3·08 | +14 37 59·49 | 20·03 |
| α Phœnicis .. .. .. .. .. .. | 2·4 | 0 21 23·53 | 2·96 | −42 50 37·04 | 19·96 |
| α Cassiopeiæ (var.) .. .. .. .. | var. | 0 34 53·14 | 3·37 | +55 59 39·98 | 19·81 |
| β Ceti .. .. .. .. .. .. .. .. | 2·1 | 0 38 37·24 | 3·0 | −18 31 47·62 | 19·76 |
| α Ursæ Minoris (*Polaris*) .. .. | 2·2 | 1 22 58·51 | 25·39 | +88 46 45·37 | 18·74 |
| α Eridani (*Achernar*) .. .. .. | 1·0 | 1 34 1·66 | 2·23 | −57 44 22·97 | 18·38 |
| α Arietis .. .. .. .. .. .. .. | 2·0 | 2 1 35·43 | 3·36 | +22 59 39·97 | 17·29 |
| α Persei .. .. .. .. .. .. .. | 1·9 | 3 17 15·08 | 4·26 | +49 36 32·40 | 13·07 |
| α Tauri (*Aldebaran*).. .. .. .. | 1·0 | 4 30 14·33 | 3·43 | +16 18 37·50 | 7·65 |
| α Aurigæ (*Capella*).. .. .. .. | 0·2 | 5 9 22·46 | 4·42 | +45 53 51·06 | 4·39 |
| β Orionis (*Rigel*) .. .. .. .. | 0·3 | 5 9 46·78 | 2·88 | −8 18 57·04 | 4·35 |
| β Tauri .. .. .. .. .. .. .. | 1·9 | 5 20 1·98 | 3·79 | +28 31 26·39 | 3·48 |
| δ Orionis .. .. .. .. .. .. .. | var. | 5 26 56·91 | 3·06 | −0 22 20·18 | 2·88 |
| α Columbæ .. .. .. .. .. .. | 2·7 | 5 36 3·85 | 2·17 | −34 7 36·42 | 2·09 |
| α Orionis (var.) .. .. .. .. .. | var. | 5 49 48·72 | 3·25 | +7 23 19·52 | 0·89 |
| α Argûs (*Canopus*) .. .. .. .. | 0·4 | 6 21 45·26 | 1·33 | −52 38 29·54 | +1·90 |
| α Canis Majoris (*Sirius*) .. .. .. | −1·4 | 6 40 47·04 | 2·68 | −16 34 47·68 | −3·55 |
| ε Canis Majoris .. .. .. .. .. .. | 1·5 | 6 54 44·10 | 2·36 | −28 50 13·84 | −4·74 |
| δ Canis Majoris .. .. .. .. .. | 1·9 | 7 4 21·92 | 2·44 | −26 14 9·09 | −5·56 |
| $\alpha^2$ Geminorum (*Castor*) .. .. .. | 2·0 | 7 28 17·06 | 3·85 | +32 6 21·56 | +7·53 |
| α Canis Minoris (*Procyon*) .. .. | 0·5 | 7 34 7·24 | 3·19 | +5 28 42·75 | 8·00 |
| β Geminorum (*Pollux*) .. .. .. | 1·1 | 7 39 15·54 | 3·72 | +28 15 55·74 | 8·41 |
| ι Argûs .. .. .. .. .. .. .. | 2·5 | 9 14 26·32 | 1·61 | −58 51 34·84 | +15·04 |
| α Hydræ .. .. .. .. .. .. .. | 2·0 | 9 22 43·37 | +2·95 | −8 13 45·48 | −15·51 |

* The mean places of stars are not to be used for finding time until they have been carefully corrected by the Annual Variation. In the Declination column + indicates North Declination and − South Declination. The correction is to applied algebraically, *i.e.*, adding like signs, subtracting unlike signs.

## TABLE IV.—(*continued*).

MEAN PLACES OF 50 OF THE PRINCIPAL FIXED STARS FOR JANUARY 1ST, 1901.

| Name. | Mag. | Right Asc. | Ann. Var. | Declination. | Ann. Var. |
|---|---|---|---|---|---|
| | | h. m. s. | | ° ′ ″ | ″ |
| α Leonis (*Regulus*) .. .. .. .. .. | 1·4 | 10 3 6·04 | +3·22 | +12 27 4·22 | −17·50 |
| η Argûs (var.) .. .. .. .. .. .. | var. | 10 41 13·12 | 2·32 | −59 9 50·31 | 18·87 |
| α Ursæ Majoris (*Dubhe*) .. .. .. .. | 2·0 | 10 57 37·40 | 3·76 | +62 7 7·95 | 19·31 |
| β Leonis (*Denebola*) .. .. .. .. .. | 2·2 | 11 44 0·65 | 3.10 | +15 7 31·81 | 20·00 |
| γ Ursæ Majoris .. .. .. .. .. .. | 2·6 | 11 48 37·59 | 3·16 | +54 14 42·77 | 20·02 |
| $\alpha^1$ Crucis .. .. .. .. .. .. .. | 1½ | 12 21 5·25 | 3·31 | −62 33 1·47 | 19·96 |
| α Virginis (*Spica*) .. .. .. .. .. | 1·2 | 13 19 58·59 | 3·16 | −10 38 40·47 | 18·84 |
| η Ursæ Majoris .. .. .. .. .. .. | 2·0 | 13 43 38·44 | 2·38 | +49 48 26·24 | 18·03 |
| β Centauri .. .. .. .. .. .. .. | 1·2 | 13 56 50·02 | 4·20 | −59 53 43·42 | 17·50 |
| α Boötis (*Arcturus*) .. .. .. .. .. | 0·0 | 14 11 8·73 | 2·81 | +19 41 51·80 | 16·85 |
| $\alpha^2$ Centauri .. .. .. .. .. .. .. | 1·0 | 14 32 52·99 | 4·53 | −60 25 27·30 | 15·75 |
| β Libræ .. .. .. .. .. .. .. | 2·7 | 15 11 40·71 | 3·23 | −9 1 3·84 | 13·43 |
| α Coronæ Borealis (*Alphecca*) .. .. | 2·4 | 15 30 29·76 | 2·53 | +27 2 51·73 | 12·17 |
| $\beta^1$ Scorpii .. .. .. .. .. .. .. | 3·0 | 15 59 40·72 | 3·48 | −19 32 4·36 | 10·04 |
| α Scorpii (*Antares*) .. .. .. .. .. | 1·1 | 16 23 20·15 | 3·67 | −26 12 44·63 | 8·20 |
| α Trianguli Australis .. .. .. | 2·2 | 16 38 10·65 | 6·31 | −68 50 45·77 | 7·00 |
| β Aræ .. .. .. .. .. .. .. .. | 2·8 | 17 17 4·15 | 4·98 | −55 26 10·53 | 3·73 |
| α Ophiuchi .. .. .. .. .. .. .. | 2·2 | 17 30 20·32 | 2·78 | +12 37 54·78 | −2·59 |
| α Lyræ (*Vega*) .. .. .. .. .. .. | 0·2 | 18 33 35·19 | 2·01 | +38 41 28·92 | +2·93 |
| σ Sagittarii .. .. .. .. .. .. .. | 2·3 | 18 49 7·59 | 3·72 | −26 25 11·36 | 4·27 |
| α Aquilæ (*Altair*) .. .. .. .. .. | 1·0 | 19 45 57·19 | 2·89 | +8 36 24·00 | 8·94 |
| α Pavonis .. .. .. .. .. .. .. | 2·1 | 20 17 49·05 | 4·77 | −57 3 8·58 | 11·34 |
| α Gruis .. .. .. .. .. .. .. .. | 1·9 | 22 1 59·73 | 3·79 | −47 26 26·14 | 17·45 |
| α Piscis Australis (*Fomalhaut*) .. | 1·3 | 22 52 10·89 | 3·30 | −30 8 49·22 | 19·18 |
| α Pegasi (*Markab*) .. .. .. .. .. | 2·6 | 22 59 49·73 | +2·98 | +14 40 21·15 | +19·36 |

## TABLE V.

APPROXIMATE TIMES OF THE MERIDIAN PASSAGES (*in apparent time*) OF 50 STARS OF THE 1ST AND 2ND MAGNITUDES ON THE FIRST DAY OF EACH MONTH.

| Mag. | Stars. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. |
| 2·1 | α Andromedæ .. .. .. .. | 5 14 | 3 2 | 1 13 | 23 19 | 21 28 | 19 25 | 17 21 | 15 16 | 13 20 | 11 32 | 9 36 | 7 32 |
| 3·0 | γ Pegasi .. (*Algenib*) .. .. | 5 19 | 3 7 | 1 18 | 23 24 | 21 33 | 19 30 | 17 26 | 15 21 | 13 25 | 11 37 | 9 41 | 7 37 |
| 2·4 | α Phœnicis .. .. .. .. .. .. | 5 34 | 3 22 | 1 33 | 23 39 | 21 48 | 19 45 | 17 41 | 15 36 | 13 40 | 11 52 | 9 54 | 7 0 |
| var. | α Cassiopeiæ .. .. .. .. | 5 46 | 3 33 | 1 44 | 23 51 | 21 59 | 19 57 | 17 52 | 15 48 | 13 52 | 12 4 | 10 7 | 8 4 |
| 2·1 | β Ceti .. .. .. .. .. .. .. | 5 50 | 3 37 | 1 48 | 23 55 | 23 3 | 20 1 | 17 56 | 15 52 | 13 55 | 12 7 | 10 11 | 8 7 |
| 2·2 | α Ursæ Minoris .. (*Polaris*) .. | 6 26 | 4 14 | 2 25 | 0 31 | 22 40 | 20 37 | 18 33 | 16 28 | 14 32 | 12 44 | 10 48 | 8 44 |
| 1·0 | α Eridani .. (*Achernar*) .. | 6 45 | 4 33 | 2 44 | 0 50 | 22 59 | 20 56 | 18 52 | 16 47 | 14 51 | 13 3 | 11 7 | 9 3 |
| 2·0 | α Arietis .. .. .. .. .. | 7 12 | 5 0 | 3 11 | 1 18 | 23 26 | 21 23 | 19 19 | 17 14 | 15 18 | 13 30 | 11 34 | 9 30 |
| 1·9 | α Persei .. .. .. .. .. .. | 8 28 | 6 16 | 4 26 | 2 33 | 0 42 | 22 39 | 20 34 | 18 30 | 16 34 | 14 46 | 12 49 | 10 46 |
| 1·0 | α Tauri .. (*Aldebaran*) .. .. | 9 41 | 7 29 | 5 40 | 3 46 | 1 55 | 23 52 | 21 48 | 19 43 | 17 47 | 15 59 | 14 3 | 11 59 |
| 0·2 | α Aurigæ .. (*Capella*) .. .. | 10 20 | 8 8 | 6 19 | 4 25 | 2 34 | 0 31 | 22 27 | 20 22 | 18 26 | 16 38 | 14 41 | 12 38 |
| 0·3 | β Orionis .. (*Rigel*) .. .. .. | 10 21 | 8 9 | 6 19 | 4 26 | 2 35 | 0 32 | 22 27 | 20 23 | 18 27 | 16 39 | 14 42 | 12 39 |
| 1·9 | β Tauri .. .. .. .. .. .. | 10 31 | 8 18 | 6 29 | 4 36 | 2 44 | 0 42 | 22 37 | 20 33 | 18 37 | 16 49 | 14 52 | 12 48 |
| var. | δ Orionis .. .. .. .. .. | 10 39 | 8 27 | 6 38 | 4 44 | 2 53 | 0 50 | 22 46 | 20 41 | 18 45 | 16 57 | 14 59 | 12 55 |
| 2·7 | α Columbæ .. .. .. .. .. | 10 47 | 8 35 | 6 46 | 4 52 | 3 1 | 0 58 | 22 54 | 20 49 | 18 53 | 17 5 | 15 9 | 13 5 |
| var. | α Orionis .. (*Betelguese*) .. | 11 1 | 8 48 | 6 59 | 5 6 | 3 14 | 1 12 | 23 7 | 21 3 | 19 7 | 17 19 | 15 22 | 13 18 |
| 0·4 | α Argûs .. (*Canopus*) .. .. | 11 33 | 9 21 | 7 32 | 5 38 | 3 47 | 1 44 | 23 40 | 21 35 | 19 39 | 17 51 | 15 55 | 13 51 |
| −1·4 | α Canis Majoris .. (*Sirius*) .. | 11 52 | 9 40 | 7 51 | 5 57 | 4 5 | 2 3 | 23 59 | 21 54 | 19 58 | 18 10 | 16 13 | 14 10 |
| 1·5 | ε Canis Majoris .. .. .. .. | 12 6 | 9 54 | 8 5 | 6 11 | 4 20 | 2 17 | 0 13 | 22 8 | 20 12 | 18 24 | 16 28 | 14 24 |
| 1·9 | δ Canis Majoris .. .. .. .. | 12 16 | 10 4 | 8 15 | 6 21 | 4 30 | 2 27 | 0 23 | 22 18 | 20 22 | 18 34 | 16 36 | 14 32 |
| 2·0 | $\alpha^2$ Geminorum .. (*Castor*) .. | 12 39 | 10 27 | 8 38 | 6 44 | 4 53 | 2 50 | 0 46 | 22 41 | 20 45 | 18 57 | 17 1 | 14 57 |
| 0·5 | α Canis Minoris .. (*Procyon*) | 12 45 | 10 33 | 8 44 | 6 50 | 4 59 | 2 56 | 0 52 | 22 47 | 20 51 | 19 3 | 17 7 | 15 3 |
| 1·1 | β Geminorum .. (*Pollux*) .. | 12 50 | 10 38 | 8 49 | 6 55 | 5 4 | 3 1 | 0 57 | 22 52 | 20 56 | 19 8 | 17 12 | 15 8 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2·5 | ι Argûs .. .. .. .. .. .. .. | 14 26 | 12 14 | 10 25 | 8 31 | 6 40 | 4 37 | 2 33 | 0 28 | 22 32 | 20 44 | 18 48 | 16 44 |
| 2·0 | α Hydræ .. .. .. .. .. .. | 14 34 | 12 21 | 10 32 | 8 39 | 6 47 | 4 45 | 2 40 | 0 36 | 22 40 | 20 52 | 18 55 | 16 51 |
| 1·4 | α Leonis .. (*Regulus*) .. .. | 15 14 | 13 2 | 11 13 | 9 19 | 7 28 | 5 25 | 3 21 | 1 16 | 23 21 | 21 32 | 19 36 | 17 32 |
| var. | η Argûs .. .. .. .. .. .. .. | 15 52 | 13 40 | 11 51 | 9 58 | 8 6 | 6 3 | 3 59 | 1 54 | 23 58 | 22 10 | 20 14 | 18 10 |
| 2·0 | α Ursæ Majoris .. .. .. .. | 16 8 | 13 56 | 12 7 | 10 13 | 8 22 | 6 19 | 4 15 | 2 10 | 0 14 | 22 26 | 20 30 | 18 26 |
| 2·2 | β Leonis .. .. .. .. .. .. | 16 55 | 14 43 | 12 54 | 11 0 | 9 9 | 7 6 | 5 2 | 2 57 | 1 1 | 23 13 | 21 17 | 19 13 |
| 2·6 | γ Ursæ Majoris .. .. .. .. | 16 59 | 14 47 | 12 58 | 11 5 | 9 13 | 7 10 | 5 6 | 3 1 | 1 5 | 23 17 | 21 21 | 19 17 |
| 1½ | $\alpha^1$ Crucis .. .. .. .. .. | 17 32 | 15 20 | 13 31 | 11 37 | 9 46 | 7 43 | 5 39 | 3 34 | 1 38 | 23 50 | 21 54 | 19 50 |
| 1·2 | α Virginis .. (*Spica*) .. .. | 18 31 | 16 19 | 14 30 | 12 36 | 10 45 | 8 42 | 6 38 | 4 33 | 2 37 | 0 49 | 22 52 | 20 49 |
| 2·0 | η Ursæ Majoris .. .. .. .. | 18 55 | 16 43 | 14 54 | 13 0 | 11 9 | 9 6 | 7 2 | 4 57 | 3 1 | 1 13 | 23 16 | 21 13 |
| 1·2 | β Centauri .. .. .. .. .. .. | 19 7 | 16 55 | 15 6 | 13 12 | 11 21 | 9 18 | 7 14 | 5 9 | 3 13 | 1 25 | 23 29 | 21 25 |
| 0·0 | α Boötis .. (*Arcturus*) .. .. | 19 22 | 17 10 | 15 21 | 13 27 | 11 36 | 9 33 | 7 29 | 5 24 | 3 28 | 1 40 | 23 44 | 21 40 |
| 1 | $\alpha^2$ Centauri .. .. .. .. .. | 19 43 | 17 31 | 15 42 | 13 49 | 11 57 | 9 54 | 7 50 | 5 45 | 3 49 | 2 1 | 0 5 | 22 1 |
| 2·7 | β Libræ.. .. .. .. .. .. .. | 20 22 | 18 10 | 16 21 | 14 27 | 12 36 | 10 33 | 8 29 | 6 24 | 4 28 | 2 40 | 0 42 | 22 38 |
| 2·4 | α Coronæ Borealis .. (*Alphecca*) | 20 42 | 18 29 | 16 40 | 14 47 | 12 55 | 10 53 | 8 48 | 6 44 | 4 48 | 3 0 | 1 3 | 22 59 |
| 3·0 | $\beta^1$ Scorpii .. .. .. .. .. | 21 10 | 18 58 | 17 9 | 15 16 | 13 24 | 11 21 | 9 17 | 7 12 | 5 16 | 3 28 | 1 32 | 23 28 |
| 1·1 | α Scorpii .. (*Antares*) .. .. | 21 34 | 19 22 | 17 33 | 15 39 | 13 48 | 11 45 | 9 41 | 7 36 | 5 40 | 3 52 | 1 56 | 23 52 |
| 2·2 | α Trianguli Australis .. .. | 21 48 | 19 36 | 17 47 | 15 53 | 14 2 | 11 59 | 9 55 | 7 50 | 5 54 | 4 6 | 2 9 | 0 6 |
| 2·8 | β Aræ .. .. .. .. .. .. .. | 22 26 | 20 14 | 18 25 | 16 31 | 14 40 | 12 37 | 10 33 | 8 28 | 6 32 | 4 44 | 2 46 | 0 42 |
| 2·2 | α Ophiuchi .. .. .. .. .. .. | 22 41 | 20 29 | 18 40 | 16 46 | 14 55 | 12 52 | 10 48 | 8 43 | 6 47 | 4 59 | 3 3 | 0 59 |
| 0·2 | α Lyræ .. (*Vega*) .. .. .. | 23 45 | 21 33 | 19 44 | 17 50 | 15 59 | 13 56 | 11 52 | 9 47 | 7 51 | 6 3 | 4 7 | 2 2 |
| 2·3 | σ Sagittarii .. .. .. .. .. .. | 0 2 | 21 50 | 20 1 | 18 7 | 16 16 | 14 13 | 12 9 | 10 4 | 8 8 | 6 20 | 4 22 | 2 18 |
| 1·0 | α Aquilæ .. (*Altair*) .. .. | 0 57 | 22 45 | 20 56 | 19 2 | 17 11 | 15 8 | 13 4 | 10 59 | 9 3 | 7 15 | 5 19 | 3 15 |
| 2·1 | α Pavonis .. .. .. .. .. .. | 1 28 | 23 16 | 21 27 | 19 33 | 17 42 | 15 39 | 13 35 | 11 30 | 9 34 | 7 46 | 5 50 | 3 46 |
| 1·9 | α Gruis.. .. .. .. .. .. .. | 3 13 | 1 0 | 23 11 | 21 18 | 19 26 | 17 24 | 15 19 | 13 15 | 11 19 | 9 31 | 7 34 | 5 30 |
| 1·3 | α Piscis Australis.. (*Fomalhaut*) | 4 3 | 1 51 | 0 2 | 22 8 | 20 17 | 18 14 | 16 10 | 14 5 | 12 9 | 10 21 | 8 25 | 6 21 |
| 2·6 | α Pegasi .. (*Markab*) .. .. | 4 11 | 1 59 | 0 10 | 22 16 | 20 25 | 18 22 | 16 18 | 14 13 | 12 17 | 10 29 | 8 32 | 6 29 |

## TABLE VI.

Correction for the Day of the Month, to be *subtracted* from the apparent time of a Star's Meridian Passage on the first day of the month.

| Day. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. |
| 1 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| 2 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 | 0 4 |
| 3 | 0 9 | 0 8 | 0 7 | 0 7 | 0 8 | 0 8 | 0 8 | 0 8 | 0 7 | 0 7 | 0 8 | 0 9 |
| 4 | 0 13 | 0 12 | 0 11 | 0 11 | 0 11 | 0 12 | 0 12 | 0 12 | 0 11 | 0 11 | 0 12 | 0 13 |
| 5 | 0 18 | 0 16 | 0 15 | 0 15 | 0 15 | 0 16 | 0 16 | 0 15 | 0 14 | 0 15 | 0 16 | 0 17 |
| 6 | 0 22 | 0 20 | 0 19 | 0 18 | 0 19 | 0 21 | 0 21 | 0 19 | 0 18 | 0 18 | 0 20 | 0 22 |
| 7 | 0 26 | 0 24 | 0 22 | 0 22 | 0 23 | 0 25 | 0 25 | 0 23 | 0 22 | 0 22 | 0 24 | 0 26 |
| 8 | 0 30 | 0 28 | 0 26 | 0 26 | 0 27 | 0 29 | 0 29 | 0 27 | 0 25 | 0 25 | 0 28 | 0 30 |
| 9 | 0 35 | 0 32 | 0 30 | 0 29 | 0 30 | 0 33 | 0 33 | 0 31 | 0 29 | 0 29 | 0 32 | 0 35 |
| 10 | 0 39 | 0 36 | 0 33 | 0 33 | 0 35 | 0 37 | 0 37 | 0 35 | 0 32 | 0 33 | 0 36 | 0 39 |
| 11 | 0 43 | 0 40 | 0 37 | 0 36 | 0 39 | 0 41 | 0 41 | 0 38 | 0 36 | 0 37 | 0 40 | 0 44 |
| 12 | 0 48 | 0 44 | 0 41 | 0 40 | 0 42 | 0 45 | 0 45 | 0 42 | 0 40 | 0 40 | 0 44 | 0 48 |
| 13 | 0 52 | 0 48 | 0 44 | 0 44 | 0 46 | 0 49 | 0 49 | 0 46 | 0 43 | 0 44 | 0 48 | 0 52 |
| 14 | 0 56 | 0 52 | 0 48 | 0 48 | 0 50 | 0 54 | 0 53 | 0 50 | 0 47 | 0 48 | 0 52 | 0 57 |
| 15 | 1 1 | 0 56 | 0 52 | 0 51 | 0 54 | 0 58 | 0 57 | 0 53 | 0 50 | 0 51 | 0 56 | 1 1 |
| 16 | 1 5 | 1 0 | 0 55 | 0 55 | 0 58 | 1 2 | 1 1 | 0 57 | 0 54 | 0 55 | 1 0 | 1 6 |
| 17 | 1 9 | 1 3 | 0 59 | 0 59 | 1 2 | 1 6 | 1 5 | 1 1 | 0 58 | 0 59 | 1 4 | 1 10 |
| 18 | 1 13 | 1 7 | 1 2 | 1 2 | 1 6 | 1 10 | 1 9 | 1 5 | 1 1 | 1 3 | 1 9 | 1 15 |
| 19 | 1 18 | 1 11 | 1 6 | 1 6 | 1 10 | 1 14 | 1 13 | 1 8 | 1 5 | 1 6 | 1 13 | 1 19 |
| 20 | 1 22 | 1 15 | 1 10 | 1 10 | 1 14 | 1 19 | 1 17 | 1 12 | 1 8 | 1 10 | 1 17 | 1 24 |
| 21 | 1 26 | 1 19 | 1 14 | 1 13 | 1 18 | 1 23 | 1 21 | 1 16 | 1 12 | 1 14 | 1 21 | 1 28 |
| 22 | 1 31 | 1 23 | 1 17 | 1 17 | 1 22 | 1 27 | 1 25 | 1 19 | 1 16 | 1 18 | 1 25 | 1 32 |
| 23 | 1 35 | 1 26 | 1 21 | 1 21 | 1 26 | 1 31 | 1 29 | 1 23 | 1 19 | 1 21 | 1 30 | 1 37 |
| 24 | 1 39 | 1 30 | 1 24 | 1 25 | 1 30 | 1 35 | 1 33 | 1 27 | 1 23 | 1 25 | 1 34 | 1 41 |
| 25 | 1 43 | 1 34 | 1 28 | 1 28 | 1 34 | 1 39 | 1 37 | 1 31 | 1 26 | 1 29 | 1 38 | 1 46 |
| 26 | 1 47 | 1 38 | 1 32 | 1 32 | 1 38 | 1 44 | 1 41 | 1 34 | 1 30 | 1 33 | 1 42 | 1 50 |
| 27 | 1 51 | 1 42 | 1 35 | 1 36 | 1 42 | 1 48 | 1 45 | 1 38 | 1 34 | 1 37 | 1 47 | 1 55 |
| 28 | 1 56 | 1 45 | 1 39 | 1 40 | 1 46 | 1 52 | 1 49 | 1 42 | 1 37 | 1 41 | 1 51 | 1 59 |
| 29 | 2 0 | .. | 1 43 | 1 44 | 1 50 | 1 56 | 1 53 | 1 45 | 1 41 | 1 44 | 1 55 | 2 3 |
| 30 | 2 4 | .. | 1 46 | 1 47 | 1 55 | 2 0 | 1 57 | 1 49 | 1 44 | 1 48 | 1 59 | 2 8 |
| 31 | 2 8 | .. | 1 50 | .. | 1 59 | .. | 2 1 | 1 52 | .. | 1 52 | .. | 2 12 |

## TABLE VII.

### Mean Astronomical Refraction.

(Barometer, 30 inches; Fahrenheit's Thermometer, 50°.)

| App. Alt. | Refr. | App. Alt. | Refr. | App. Alt. | Refr. | App. Alt. | Refr. |
|---|---|---|---|---|---|---|---|
| ° ′ | ′ ″ | ° ′ | ′ ″ | ° ′ | ′ ″ | ° ′ | ′ ″ |
| 0 00 | 34 17 | 4 00 | 11 47 | 6 55 | 7 30 | 10 00 | 5 20 |
| 0 10 | 32 15 | 4 05 | 11 36 | 7 00 | 7 25 | 10 10 | 5 15 |
| 0 20 | 30 23 | 4 10 | 11 26 | 7 05 | 7 20 | 10 20 | 5 10 |
| 0 30 | 28 41 | 4 15 | 11 15 | 7 10 | 7 16 | 10 30 | 5 06 |
| 0 40 | 27 07 | 4 20 | 11 05 | 7 15 | 7 11 | 10 40 | 5 01 |
| 0 50 | 25 41 | 4 25 | 10 55 | 7 20 | 7 07 | 10 50 | 4 56 |
| 1 00 | 24 22 | 4 30 | 10 46 | 7 25 | 7 03 | 11 00 | 4 52 |
| 1 10 | 23 09 | 4 35 | 10 37 | 7 30 | 6 59 | 11 10 | 4 48 |
| 1 20 | 22 02 | 4 40 | 10 28 | 7 35 | 6 54 | 11 20 | 4 44 |
| 1 30 | 21 00 | 4 45 | 10 19 | 7 40 | 6 50 | 11 30 | 4 40 |
| 1 40 | 20 02 | 4 50 | 10 10 | 7 45 | 6 46 | 11 40 | 4 36 |
| 1 50 | 19 09 | 4 55 | 10 02 | 7 50 | 6 42 | 11 50 | 4 32 |
| 2 00 | 18 20 | 5 00 | 9 54 | 7 55 | 6 38 | 12 00 | 4 28 |
| 2 10 | 17 34 | 5 05 | 9 46 | 8 00 | 6 35 | 12 10 | 4 25 |
| 2 15 | 17 12 | 5 10 | 9 38 | 8 05 | 6 31 | 12 20 | 4 21 |
| 2 20 | 16 51 | 5 15 | 9 30 | 8 10 | 6 27 | 12 30 | 4 18 |
| 2 25 | 16 31 | 5 20 | 9 23 | 8 15 | 6 23 | 12 40 | 4 14 |
| 2 30 | 16 11 | 5 25 | 9 16 | 8 20 | 6 20 | 12 50 | 4 11 |
| 2 35 | 15 52 | 5 30 | 9 09 | 8 25 | 6 16 | 13 00 | 4 08 |
| 2 40 | 15 34 | 5 35 | 9 02 | 8 30 | 6 13 | 13 10 | 4 05 |
| 2 45 | 15 16 | 5 40 | 8 55 | 8 35 | 6 09 | 13 20 | 4 02 |
| 2 50 | 14 59 | 5 45 | 8 48 | 8 40 | 6 06 | 13 30 | 3 59 |
| 2 55 | 14 42 | 5 50 | 8 42 | 8 45 | 6 03 | 13 40 | 3 56 |
| 3 00 | 14 26 | 5 55 | 8 36 | 8 50 | 6 00 | 13 50 | 3 53 |
| 3 05 | 14 10 | 6 00 | 8 30 | 8 55 | 5 57 | 14 00 | 3 50 |
| 3 10 | 13 55 | 6 05 | 8 24 | 9 00 | 5 54 | 14 10 | 3 47 |
| 3 15 | 13 41 | 6 10 | 8 18 | 9 05 | 5 51 | 14 20 | 3 45 |
| 3 20 | 13 27 | 6 15 | 8 12 | 9 10 | 5 48 | 14 30 | 3 42 |
| 3 25 | 13 13 | 6 20 | 8 06 | 9 15 | 5 45 | 14 40 | 3 40 |
| 3 30 | 13 00 | 6 25 | 8 01 | 9 20 | 5 42 | 14 50 | 3 37 |
| 3 35 | 12 47 | 6 30 | 7 56 | 9 25 | 5 39 | 15 00 | 3 35 |
| 3 40 | 12 34 | 6 35 | 7 50 | 9 30 | 5 36 | 15 10 | 3 32 |
| 3 45 | 12 22 | 6 40 | 7 45 | 9 35 | 5 33 | 15 20 | 3 30 |
| 3 50 | 12 10 | 6 45 | 7 40 | 9 40 | 5 31 | 15 30 | 3 28 |
| 3 55 | 11 58 | 6 50 | 7 35 | 9 50 | 5 25 | 15 40 | 3 25 |

## TABLE VII.—(*continued*).

### Mean Astronomical Refraction.

(Barom. 30 inches; Therm. 50° Fahr.)

| App. Alt. | Refr. | App. Alt. | Refr. | App. Alt. | Refr. |
|---|---|---|---|---|---|
| ° ′ | ′ ″ | ° ′ | ′ ″ | ° ′ | ′ ″ |
| 15 50 | 3 23 | 31 00 | 1 37 | 57 00 | 0 37·9 |
| 16 00 | 3 21 | 31 30 | 1 35 | 58 00 | 0 36·5 |
| 16 10 | 3 19 | 32 00 | 1 33 | 59 00 | 0 35·1 |
| 16 20 | 3 17 | 32 30 | 1 31 | 60 00 | 0 33·7 |
| 16 30 | 3 15 | 33 00 | 1 30 | 61 00 | 0 32·4 |
| 16 40 | 3 13 | 33 30 | 1 28 | 62 00 | 0 31·0 |
| 16 50 | 3 11 | 34 00 | 1 26 | 63 00 | 0 29·8 |
| 17 00 | 3 09 | 34 30 | 1 25 | 64 00 | 0 28·5 |
| 17 30 | 3 03 | 35 00 | 1 23·2 | 65 00 | 0 27·2 |
| 18 00 | 2 58 | 35 30 | 1 21·7 | 66 00 | 0 26·0 |
| 18 30 | 2 53 | 36 00 | 1 20·2 | 67 00 | 0 24·8 |
| 19 00 | 2 48 | 36 30 | 1 18·8 | 68 00 | 0 23·6 |
| 19 30 | 2 44 | 37 00 | 1 17·4 | 69 00 | 0 22·4 |
| 20 00 | 2 39 | 37 30 | 1 16·0 | 70 00 | 0 21·3 |
| 20 30 | 2 35 | 38 00 | 1 14·6 | 71 00 | 0 20·1 |
| 21 00 | 2 31 | 38 30 | 1 13·3 | 72 00 | 0 19·0 |
| 21 30 | 2 27 | 39 00 | 1 12·0 | 73 00 | 0 17·9 |
| 22 00 | 2 24 | 39 30 | 1 10·7 | 74 00 | 0 16·7 |
| 22 30 | 2 20 | 40 00 | 1 09·5 | 75 00 | 0 15·7 |
| 23 00 | 2 17 | 41 00 | 1 07·1 | 76 00 | 0 14·6 |
| 23 30 | 2 13 | 42 00 | 1 04·8 | 77 00 | 0 13·5 |
| 24 00 | 2 10 | 43 00 | 1 02·6 | 78 00 | 0 12·4 |
| 24 30 | 2 07 | 44 00 | 1 00·4 | 79 00 | 0 11·3 |
| 25 00 | 2 05 | 45 00 | 0 58·4 | 80 00 | 0 10·3 |
| 25 30 | 2 02 | 46 00 | 0 56·3 | 81 00 | 0 09·2 |
| 26 00 | 1 59 | 47 00 | 0 54·4 | 82 00 | 0 08·2 |
| 26 30 | 1 56 | 48 00 | 0 52·6 | 83 00 | 0 07·2 |
| 27 00 | 1 54 | 49 00 | 0 50·7 | 84 00 | 0 06·1 |
| 27 30 | 1 51 | 50 00 | 0 49·0 | 85 00 | 0 05·1 |
| 28 00 | 1 49 | 51 00 | 0 47·3 | 86 00 | 0 04·1 |
| 28 30 | 1 47 | 52 00 | 0 45·6 | 87 00 | 0 03·1 |
| 29 00 | 1 45 | 53 00 | 0 44·0 | 88 00 | 0 02·0 |
| 29 30 | 1 43 | 54 00 | 0 42·4 | 89 00 | 0 01·0 |
| 30 00 | 1 41 | 55 00 | 0 40·9 | 90 00 | 0 00·0 |
| 30 30 | 1 39 | 56 00 | 0 39·4 | | |

Corrections when Barom. differs from 30 inches or Therm. from 50° Fahr.

**Barometer.**

| App. Alt. | For each inch above or below 30 inches:—*add*, if above 30; *subtract*, if below. |
|---|---|
| ° | ″ |
| 20 | 5 |
| 25 | 4 |
| 30 | 3 |
| 35 | 3 |
| 40 | 2 |
| 45 | 2 |
| 50 | 2 |
| 55 | 1 |
| 60 | 1 |
| 65 | 1 |
| 70 | 1 |

**Thermometer.**

| App. Alt. | For each 10 degrees above or below 50° Fahr.:—*subtract*, if above 50°; *add*, if below. |
|---|---|
| ° | ″ |
| 20 | 3 |
| 25 | 3 |
| 30 | 2 |
| 35 | 2 |
| 40 | 1 |
| 45 | 1 |
| 50 | 1 |
| 55 | 1 |
| 60 | 1 |
| 65 | 1 |
| 70 | 0 |

## TABLE VIII.

### Semi-diurnal and Semi-nocturnal Arches, showing the time of the Rising and Setting of the Sun, Moon, or Equatorial Stars.

Declination.

| Lat. | 0° | 1° | 2° | 3° | 4° | 5° | 6° | 7° | 8° | 9° | 10° | 11° | 12° | 13° | Lat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | ° |
| 1 | 6 0 | 6 0 | 6 0 | 6 0 | 6 0 | 6 0 | 6 0 | 6 0 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 1 |
| 2 | 6 0 | 6 0 | 6 0 | 6 0 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 2 | 6 2 | 6 2 | 2 |
| 3 | 6 0 | 6 0 | 6 0 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 2 | 6 2 | 6 2 | 6 2 | 6 3 | 6 3 | 3 |
| 4 | 6 0 | 6 0 | 6 1 | 6 1 | 6 1 | 6 1 | 6 2 | 6 2 | 6 2 | 6 3 | 6 3 | 6 3 | 6 3 | 6 4 | 4 |
| 5 | 6 0 | 6 0 | 6 1 | 6 1 | 6 1 | 6 2 | 6 2 | 6 2 | 6 3 | 6 3 | 6 4 | 6 4 | 6 4 | 6 5 | 5 |
| 6 | 6 0 | 6 0 | 6 1 | 6 1 | 6 2 | 6 2 | 6 3 | 6 3 | 6 3 | 6 4 | 6 4 | 6 5 | 6 5 | 6 6 | 6 |
| 7 | 6 0 | 6 0 | 6 1 | 6 1 | 6 2 | 6 2 | 6 3 | 6 3 | 6 4 | 6 4 | 6 5 | 6 5 | 6 6 | 6 6 | 7 |
| 8 | 6 0 | 6 1 | 6 1 | 6 2 | 6 2 | 6 3 | 6 3 | 6 4 | 6 5 | 6 5 | 6 6 | 6 6 | 6 7 | 6 7 | 8 |
| 9 | 6 0 | 6 1 | 6 1 | 6 2 | 6 3 | 6 3 | 6 4 | 6 4 | 6 5 | 6 6 | 6 6 | 6 7 | 6 8 | 6 8 | 9 |
| 10 | 6 0 | 6 1 | 6 1 | 6 2 | 6 3 | 6 4 | 6 4 | 6 5 | 6 6 | 6 6 | 6 7 | 6 8 | 6 9 | 6 9 | 10 |
| 11 | 6 0 | 6 1 | 6 2 | 6 2 | 6 3 | 6 4 | 6 5 | 6 5 | 6 6 | 6 7 | 6 8 | 6 9 | 6 9 | 6 10 | 11 |
| 12 | 6 0 | 6 1 | 6 2 | 6 3 | 6 3 | 6 4 | 6 5 | 6 6 | 6 7 | 6 8 | 6 9 | 6 9 | 6 10 | 6 11 | 12 |
| 13 | 6 0 | 6 1 | 6 2 | 6 3 | 6 4 | 6 5 | 6 6 | 6 6 | 6 7 | 6 8 | 6 9 | 6 10 | 6 11 | 6 12 | 13 |
| 14 | 6 0 | 6 1 | 6 2 | 6 3 | 6 4 | 6 5 | 6 6 | 6 7 | 6 8 | 6 9 | 6 10 | 6 11 | 6 12 | 6 13 | 14 |
| 15 | 6 0 | 6 1 | 6 2 | 6 3 | 6 4 | 6 5 | 6 6 | 6 8 | 6 9 | 6 10 | 6 11 | 6 12 | 6 13 | 6 14 | 15 |
| 16 | 6 0 | 6 1 | 6 2 | 6 3 | 6 5 | 6 6 | 6 7 | 6 8 | 6 9 | 6 10 | 6 12 | 6 13 | 6 14 | 6 15 | 16 |
| 17 | 6 0 | 6 1 | 6 2 | 6 4 | 6 5 | 6 6 | 6 7 | 6 9 | 6 10 | 6 11 | 6 12 | 6 14 | 6 15 | 6 16 | 17 |
| 18 | 6 0 | 6 1 | 6 3 | 6 4 | 6 5 | 6 7 | 6 8 | 6 9 | 6 10 | 6 12 | 6 13 | 6 14 | 6 16 | 6 17 | 18 |
| 19 | 6 0 | 6 1 | 6 3 | 6 4 | 6 6 | 6 7 | 6 8 | 6 10 | 6 11 | 6 13 | 6 14 | 6 15 | 6 17 | 6 18 | 19 |
| 20 | 6 0 | 6 1 | 6 3 | 6 4 | 6 6 | 6 7 | 6 9 | 6 10 | 6 12 | 6 13 | 6 15 | 6 16 | 6 18 | 6 19 | 20 |
| 21 | 6 0 | 6 2 | 6 3 | 6 5 | 6 6 | 6 8 | 6 9 | 6 11 | 6 12 | 6 14 | 6 16 | 6 17 | 6 19 | 6 20 | 21 |
| 22 | 6 0 | 6 2 | 6 3 | 6 5 | 6 6 | 6 8 | 6 10 | 6 11 | 6 13 | 6 15 | 6 16 | 6 18 | 6 20 | 6 21 | 22 |
| 23 | 6 0 | 6 2 | 6 3 | 6 5 | 6 7 | 6 9 | 6 10 | 6 12 | 6 14 | 6 15 | 6 17 | 6 19 | 6 21 | 6 22 | 23 |
| 24 | 6 0 | 6 2 | 6 4 | 6 5 | 6 7 | 6 9 | 6 11 | 6 13 | 6 14 | 6 16 | 6 18 | 6 20 | 6 22 | 6 24 | 24 |
| 25 | 6 0 | 6 2 | 6 4 | 6 6 | 6 7 | 6 9 | 6 11 | 6 13 | 6 15 | 6 17 | 6 19 | 6 21 | 6 23 | 6 25 | 25 |
| 26 | 6 0 | 6 2 | 6 4 | 6 6 | 6 8 | 6 10 | 6 12 | 6 14 | 6 16 | 6 18 | 6 20 | 6 22 | 6 24 | 6 26 | 26 |
| 27 | 6 0 | 6 2 | 6 4 | 6 6 | 6 8 | 6 10 | 6 12 | 6 14 | 6 16 | 6 19 | 6 21 | 6 23 | 6 25 | 6 27 | 27 |
| 28 | 6 0 | 6 2 | 6 4 | 6 6 | 6 9 | 6 11 | 6 13 | 6 15 | 6 17 | 6 19 | 6 22 | 6 24 | 6 26 | 6 28 | 28 |
| 29 | 6 0 | 6 2 | 6 4 | 6 7 | 6 9 | 6 11 | 6 13 | 6 16 | 6 18 | 6 20 | 6 22 | 6 25 | 6 27 | 6 29 | 29 |
| 30 | 6 0 | 6 2 | 6 5 | 6 7 | 6 9 | 6 12 | 6 14 | 6 16 | 6 19 | 6 21 | 6 23 | 6 26 | 6 28 | 6 31 | 30 |
| 31 | 6 0 | 6 2 | 6 5 | 6 7 | 6 10 | 6 12 | 6 14 | 6 17 | 6 19 | 6 22 | 6 24 | 6 27 | 6 29 | 6 32 | 31 |
| 32 | 6 0 | 6 2 | 6 5 | 6 8 | 6 10 | 6 13 | 6 15 | 6 18 | 6 20 | 6 23 | 6 25 | 6 28 | 6 31 | 6 33 | 32 |
| 33 | 6 0 | 6 3 | 6 5 | 6 8 | 6 10 | 6 13 | 6 16 | 6 18 | 6 21 | 6 24 | 6 26 | 6 29 | 6 32 | 6 34 | 33 |
| 34 | 6 0 | 6 3 | 6 5 | 6 8 | 6 11 | 6 14 | 6 16 | 6 19 | 6 22 | 6 25 | 6 27 | 6 30 | 6 33 | 6 36 | 34 |
| 35 | 6 0 | 6 3 | 6 6 | 6 8 | 6 11 | 6 14 | 6 17 | 6 20 | 6 23 | 6 25 | 6 28 | 6 31 | 6 34 | 6 37 | 35 |
| 36 | 6 0 | 6 3 | 6 6 | 6 9 | 6 12 | 6 15 | 6 18 | 6 20 | 6 23 | 6 26 | 6 29 | 6 32 | 6 36 | 6 39 | 36 |
| 37 | 6 0 | 6 3 | 6 6 | 6 9 | 6 12 | 6 15 | 6 18 | 6 21 | 6 24 | 6 27 | 6 31 | 6 34 | 6 37 | 6 40 | 37 |
| 38 | 6 0 | 6 3 | 6 6 | 6 9 | 6 13 | 6 16 | 6 19 | 6 22 | 6 25 | 6 28 | 6 32 | 6 35 | 6 38 | 6 42 | 38 |
| 39 | 6 0 | 6 3 | 6 6 | 6 10 | 6 13 | 6 16 | 6 20 | 6 23 | 6 26 | 6 29 | 6 33 | 6 36 | 6 40 | 6 43 | 39 |
| 40 | 6 0 | 6 3 | 6 7 | 6 10 | 6 13 | 6 17 | 6 20 | 6 24 | 6 27 | 6 31 | 6 34 | 6 38 | 6 41 | 6 45 | 40 |
| 41 | 6 0 | 6 3 | 6 7 | 6 10 | 6 14 | 6 17 | 6 21 | 6 25 | 6 28 | 6 32 | 6 35 | 6 39 | 6 43 | 6 46 | 41 |
| 42 | 6 0 | 6 4 | 6 7 | 6 11 | 6 14 | 6 18 | 6 22 | 6 25 | 6 29 | 6 33 | 6 37 | 6 40 | 6 44 | 6 48 | 42 |
| 43 | 6 0 | 6 4 | 6 7 | 6 11 | 6 15 | 6 19 | 6 22 | 6 26 | 6 30 | 6 34 | 6 38 | 6 42 | 6 46 | 6 50 | 43 |
| 44 | 6 0 | 6 4 | 6 8 | 6 12 | 6 15 | 6 19 | 6 23 | 6 27 | 6 31 | 6 35 | 6 39 | 6 43 | 6 47 | 6 52 | 44 |
| 45 | 6 0 | 6 4 | 6 8 | 6 12 | 6 16 | 6 20 | 6 24 | 6 28 | 6 32 | 6 36 | 6 41 | 6 45 | 6 49 | 6 53 | 45 |
| 46 | 6 0 | 6 4 | 6 8 | 6 12 | 6 17 | 6 21 | 6 25 | 6 29 | 6 33 | 6 38 | 6 42 | 6 46 | 6 51 | 6 55 | 46 |
| 47 | 6 0 | 6 4 | 6 9 | 6 13 | 6 17 | 6 22 | 6 26 | 6 30 | 6 35 | 6 39 | 6 44 | 6 48 | 6 53 | 6 57 | 47 |
| 48 | 6 0 | 6 4 | 6 9 | 6 13 | 6 18 | 6 22 | 6 27 | 6 31 | 6 36 | 6 41 | 6 45 | 6 50 | 6 55 | 6 59 | 48 |
| 49 | 6 0 | 6 5 | 6 9 | 6 14 | 6 18 | 6 23 | 6 28 | 6 32 | 6 37 | 6 42 | 6 47 | 6 52 | 6 57 | 7 2 | 49 |
| 50 | 6 0 | 6 5 | 6 10 | 6 14 | 6 19 | 6 24 | 6 29 | 6 34 | 6 39 | 6 44 | 6 49 | 6 54 | 6 59 | 7 4 | 50 |
| 51 | 6 0 | 6 5 | 6 10 | 6 15 | 6 20 | 6 25 | 6 30 | 6 35 | 6 40 | 6 45 | 6 50 | 6 56 | 7 1 | 7 6 | 51 |
| 52 | 6 0 | 6 5 | 6 10 | 6 15 | 6 21 | 6 26 | 6 31 | 6 36 | 6 41 | 6 47 | 6 52 | 6 58 | 7 3 | 7 9 | 52 |
| 53 | 6 0 | 6 5 | 6 11 | 6 16 | 6 21 | 6 27 | 6 32 | 6 38 | 6 43 | 6 49 | 6 54 | 7 0 | 7 6 | 7 11 | 53 |
| 54 | 6 0 | 6 5 | 6 11 | 6 17 | 6 22 | 6 28 | 6 33 | 6 39 | 6 45 | 6 50 | 6 56 | 7 2 | 7 8 | 7 14 | 54 |
| 55 | 6 0 | 6 6 | 6 11 | 6 17 | 6 23 | 6 29 | 6 35 | 6 40 | 6 46 | 6 52 | 6 59 | 7 4 | 7 11 | 7 17 | 55 |
| 56 | 6 0 | 6 6 | 6 12 | 6 18 | 6 24 | 6 30 | 6 36 | 6 42 | 6 48 | 6 54 | 7 1 | 7 7 | 7 13 | 7 20 | 56 |
| 57 | 6 0 | 6 6 | 6 12 | 6 19 | 6 25 | 6 31 | 6 37 | 6 44 | 6 50 | 6 56 | 7 3 | 7 10 | 7 16 | 7 23 | 57 |
| 58 | 6 0 | 6 6 | 6 13 | 6 19 | 6 26 | 6 32 | 6 39 | 6 45 | 6 52 | 6 59 | 7 6 | 7 12 | 7 20 | 7 27 | 58 |
| 59 | 6 0 | 6 7 | 6 13 | 6 20 | 6 27 | 6 33 | 6 40 | 6 47 | 6 54 | 7 1 | 7 8 | 7 15 | 7 23 | 7 30 | 59 |
| 60 | 6 0 | 6 7 | 6 14 | 6 21 | 6 28 | 6 35 | 6 42 | 6 49 | 6 56 | 7 4 | 7 11 | 7 19 | 7 26 | 7 34 | 60 |

## TABLE VIII.—(*continued*).

### Semi-diurnal and Semi-nocturnal Arches, showing the time of the Rising and Setting of the Sun, Moon, or Equatorial Stars.

Declination.

| Lat. | 14° | 15° | 16° | 17° | 18° | 19° | 20° | 21° | 21½° | 22° | 22½° | 23° | 23° 23′ | Lat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | h. m. | ° |
| 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 1 | 6 2 | 6 2 | 6 2 | 6 2 | 6 2 | 6 2 | 1 |
| 2 | 6 2 | 6 2 | 6 2 | 6 2 | 6 3 | 6 3 | 6 3 | 6 3 | 6 3 | 6 3 | 6 3 | 6 3 | 6 3 | 2 |
| 3 | 6 3 | 6 3 | 6 3 | 6 4 | 6 4 | 6 4 | 6 4 | 6 5 | 6 5 | 6 5 | 6 5 | 6 5 | 6 5 | 3 |
| 4 | 6 4 | 6 4 | 6 5 | 6 5 | 6 5 | 6 6 | 6 6 | 6 6 | 6 6 | 6 6 | 6 7 | 6 7 | 6 7 | 4 |
| 5 | 6 5 | 6 5 | 6 6 | 6 6 | 6 7 | 6 7 | 6 7 | 6 8 | 6 8 | 6 8 | 6 8 | 6 9 | 6 9 | 5 |
| 6 | 6 6 | 6 6 | 6 7 | 6 7 | 6 8 | 6 8 | 6 9 | 6 9 | 6 10 | 6 10 | 6 10 | 6 10 | 6 10 | 6 |
| 7 | 6 7 | 6 8 | 6 8 | 6 9 | 6 9 | 6 10 | 6 10 | 6 11 | 6 11 | 6 11 | 6 12 | 6 12 | 6 12 | 7 |
| 8 | 6 8 | 6 9 | 6 8 | 6 10 | 6 10 | 6 11 | 6 12 | 6 12 | 6 13 | 6 13 | 6 13 | 6 14 | 6 14 | 8 |
| 9 | 6 9 | 6 10 | 6 10 | 6 11 | 6 12 | 6 13 | 6 13 | 6 14 | 6 14 | 6 15 | 6 15 | 6 15 | 6 16 | 9 |
| 10 | 6 10 | 6 11 | 6 12 | 6 12 | 6 13 | 6 14 | 6 15 | 6 16 | 6 16 | 6 16 | 6 17 | 6 17 | 6 18 | 10 |
| 11 | 6 11 | 6 12 | 6 13 | 6 14 | 6 14 | 6 15 | 6 16 | 6 17 | 6 18 | 6 18 | 6 18 | 6 19 | 6 19 | 11 |
| 12 | 6 12 | 6 13 | 6 14 | 6 15 | 6 16 | 6 17 | 6 18 | 6 19 | 6 19 | 6 20 | 6 20 | 6 21 | 6 21 | 12 |
| 13 | 6 13 | 6 14 | 6 15 | 6 16 | 6 17 | 6 18 | 6 19 | 6 20 | 6 21 | 6 21 | 6 22 | 6 22 | 6 23 | 13 |
| 14 | 6 14 | 6 15 | 6 16 | 6 17 | 6 19 | 6 20 | 6 21 | 6 22 | 6 23 | 6 23 | 6 24 | 6 24 | 6 25 | 14 |
| 15 | 6 15 | 6 16 | 6 18 | 6 19 | 6 20 | 6 21 | 6 22 | 6 24 | 6 24 | 6 25 | 6 25 | 6 26 | 6 27 | 15 |
| 16 | 6 16 | 6 18 | 6 19 | 6 20 | 6 21 | 6 23 | 6 24 | 6 25 | 6 26 | 6 27 | 6 27 | 6 28 | 6 29 | 16 |
| 17 | 6 17 | 6 19 | 6 20 | 6 21 | 6 23 | 6 24 | 6 26 | 6 27 | 6 28 | 6 28 | 6 29 | 6 30 | 6 31 | 17 |
| 18 | 6 19 | 6 20 | 6 21 | 6 23 | 6 24 | 6 26 | 6 27 | 6 29 | 6 29 | 6 30 | 6 31 | 6 32 | 6 32 | 18 |
| 19 | 6 20 | 6 21 | 6 23 | 6 24 | 6 26 | 6 27 | 6 29 | 6 30 | 6 31 | 6 32 | 6 33 | 6 34 | 6 34 | 19 |
| 20 | 6 21 | 6 22 | 6 24 | 6 26 | 6 27 | 6 29 | 6 30 | 6 32 | 6 33 | 6 34 | 6 35 | 6 36 | 6 36 | 20 |
| 21 | 6 22 | 6 24 | 6 25 | 6 27 | 6 29 | 6 30 | 6 32 | 6 34 | 6 35 | 6 36 | 6 37 | 6 38 | 6 38 | 21 |
| 22 | 6 23 | 6 25 | 6 27 | 6 28 | 6 30 | 6 32 | 6 34 | 6 36 | 6 37 | 6 38 | 6 39 | 6 40 | 6 41 | 22 |
| 23 | 6 24 | 6 26 | 6 28 | 6 30 | 6 32 | 6 34 | 6 36 | 6 38 | 6 38 | 6 39 | 6 40 | 6 42 | 6 43 | 23 |
| 24 | 6 25 | 6 27 | 6 29 | 6 31 | 6 33 | 6 35 | 6 37 | 6 39 | 6 40 | 6 41 | 6 42 | 6 44 | 6 45 | 24 |
| 25 | 6 27 | 6 29 | 6 31 | 6 33 | 6 35 | 6 37 | 6 39 | 6 41 | 6 42 | 6 43 | 6 45 | 6 46 | 6 47 | 25 |
| 26 | 6 28 | 6 30 | 6 32 | 6 34 | 6 36 | 6 39 | 6 41 | 6 43 | 6 44 | 6 45 | 6 47 | 6 48 | 6 49 | 26 |
| 27 | 6 29 | 6 31 | 6 34 | 6 36 | 6 38 | 6 40 | 6 43 | 6 45 | 6 46 | 6 48 | 6 49 | 6 50 | 6 51 | 27 |
| 28 | 6 30 | 6 33 | 6 35 | 6 37 | 6 40 | 6 42 | 6 45 | 6 47 | 6 48 | 6 50 | 6 51 | 6 52 | 6 53 | 28 |
| 29 | 6 32 | 6 34 | 6 37 | 6 39 | 6 42 | 6 44 | 6 47 | 6 49 | 6 50 | 6 52 | 6 53 | 6 54 | 6 56 | 29 |
| 30 | 6 33 | 6 36 | 6 38 | 6 41 | 6 43 | 6 46 | 6 49 | 6 51 | 6 53 | 6 54 | 6 55 | 6 57 | 6 58 | 30 |
| 31 | 6 34 | 6 37 | 6 40 | 6 42 | 6 45 | 6 48 | 6 51 | 6 53 | 6 55 | 6 56 | 6 58 | 6 59 | 7 0 | 31 |
| 32 | 6 36 | 6 39 | 6 41 | 6 44 | 6 47 | 6 50 | 6 53 | 6 56 | 6 57 | 6 58 | 7 0 | 7 2 | 7 3 | 32 |
| 33 | 6 37 | 6 40 | 6 43 | 6 46 | 6 49 | 6 53 | 6 55 | 6 58 | 6 59 | 7 1 | 7 2 | 7 4 | 7 5 | 33 |
| 34 | 6 39 | 6 42 | 6 45 | 6 48 | 6 51 | 6 54 | 6 57 | 7 0 | 7 2 | 7 3 | 7 5 | 7 7 | 7 8 | 34 |
| 35 | 6 40 | 6 43 | 6 46 | 6 49 | 6 53 | 6 56 | 6 59 | 7 2 | 7 4 | 7 6 | 7 7 | 7 9 | 7 11 | 35 |
| 36 | 6 42 | 6 45 | 6 48 | 6 51 | 6 55 | 6 58 | 7 1 | 7 5 | 7 7 | 7 8 | 7 10 | 7 12 | 7 14 | 36 |
| 37 | 6 43 | 6 47 | 6 50 | 6 53 | 6 57 | 7 0 | 7 4 | 7 7 | 7 9 | 7 11 | 7 13 | 7 15 | 7 16 | 37 |
| 38 | 6 45 | 6 48 | 6 52 | 6 55 | 6 59 | 7 2 | 7 6 | 7 10 | 7 12 | 7 14 | 7 16 | 7 17 | 7 19 | 38 |
| 39 | 6 47 | 6 50 | 6 54 | 6 57 | 7 1 | 7 5 | 7 9 | 7 12 | 7 14 | 7 16 | 7 18 | 7 20 | 7 22 | 39 |
| 40 | 6 48 | 6 52 | 6 56 | 6 59 | 7 3 | 7 7 | 7 11 | 7 15 | 7 17 | 7 19 | 7 21 | 7 23 | 7 25 | 40 |
| 41 | 6 50 | 6 54 | 6 58 | 7 2 | 7 6 | 7 10 | 7 14 | 7 18 | 7 20 | 7 22 | 7 24 | 7 27 | 7 29 | 41 |
| 42 | 6 52 | 6 56 | 7 0 | 7 4 | 7 8 | 7 12 | 7 17 | 7 21 | 7 23 | 7 25 | 7 28 | 7 30 | 7 32 | 42 |
| 43 | 6 54 | 6 58 | 7 2 | 7 6 | 7 11 | 7 15 | 7 19 | 7 24 | 7 26 | 7 29 | 7 31 | 7 33 | 7 36 | 43 |
| 44 | 6 56 | 7 0 | 7 4 | 7 9 | 7 13 | 7 18 | 7 22 | 7 27 | 7 29 | 7 32 | 7 34 | 7 37 | 7 39 | 44 |
| 45 | 6 58 | 7 2 | 7 7 | 7 11 | 7 16 | 7 21 | 7 25 | 7 30 | 7 33 | 7 35 | 7 38 | 7 40 | 7 43 | 45 |
| 46 | 7 0 | 7 4 | 7 9 | 7 14 | 7 19 | 7 24 | 7 29 | 7 34 | 7 36 | 7 39 | 7 42 | 7 44 | 7 47 | 46 |
| 47 | 7 2 | 7 7 | 7 12 | 7 17 | 7 22 | 7 27 | 7 32 | 7 37 | 7 40 | 7 43 | 7 46 | 7 48 | 7 51 | 47 |
| 48 | 7 4 | 7 9 | 7 14 | 7 19 | 7 25 | 7 30 | 7 35 | 7 41 | 7 44 | 7 47 | 7 50 | 7 53 | 7 55 | 48 |
| 49 | 7 7 | 7 12 | 7 17 | 7 22 | 7 28 | 7 33 | 7 39 | 7 45 | 7 48 | 7 51 | 7 54 | 7 57 | 8 0 | 49 |
| 50 | 7 9 | 7 14 | 7 20 | 7 25 | 7 31 | 7 37 | 7 43 | 7 49 | 7 52 | 7 55 | 7 58 | 8 2 | 8 5 | 50 |
| 51 | 7 12 | 7 17 | 7 23 | 7 29 | 7 35 | 7 41 | 7 47 | 7 53 | 7 56 | 8 0 | 8 3 | 8 6 | 8 10 | 51 |
| 52 | 7 14 | 7 20 | 7 26 | 7 32 | 7 38 | 7 45 | 7 51 | 7 58 | 8 1 | 8 5 | 8 8 | 8 12 | 8 15 | 52 |
| 53 | 7 17 | 7 23 | 7 29 | 7 36 | 7 42 | 7 49 | 7 56 | 8 2 | 8 6 | 8 10 | 8 13 | 8 17 | 8 21 | 53 |
| 54 | 7 20 | 7 27 | 7 33 | 7 40 | 7 46 | 7 53 | 8 0 | 8 8 | 8 11 | 8 15 | 8 19 | 8 23 | 8 25 | 54 |
| 55 | 7 23 | 7 30 | 7 37 | 7 44 | 7 51 | 7 58 | 8 5 | 8 13 | 8 17 | 8 21 | 8 25 | 8 29 | 8 33 | 55 |
| 56 | 7 27 | 7 34 | 7 41 | 7 48 | 7 55 | 8 3 | 8 11 | 8 19 | 8 23 | 8 27 | 8 32 | 8 36 | 8 40 | 56 |
| 57 | 7 30 | 7 37 | 7 45 | 7 52 | 8 0 | 8 8 | 8 16 | 8 25 | 8 29 | 8 34 | 8 39 | 8 43 | 8 48 | 57 |
| 58 | 7 34 | 7 42 | 7 49 | 7 57 | 8 5 | 8 14 | 8 22 | 8 32 | 8 36 | 8 41 | 8 46 | 8 51 | 8 56 | 58 |
| 59 | 7 38 | 7 46 | 7 54 | 8 2 | 8 11 | 8 20 | 8 29 | 8 39 | 8 44 | 8 49 | 8 54 | 9 0 | 9 5 | 59 |
| 60 | 7 42 | 7 51 | 7 59 | 8 8 | 8 17 | 8 26 | 8 36 | 8 47 | 8 52 | 8 58 | 9 3 | 9 9 | 9 15 | 60 |

## TABLE IX.

DISTANCE OF THE SEA HORIZON UNCORRECTED FOR EFFECTS OF REFRACTION.*

| Height. | Distance. | Height. | Distance. | Height. | Distance. | Height. | Distance. | Height. | Distance. | Height. | Distance. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Feet. | Miles. | Feet. | Miles. | Feet. | Miles. | Feet. | Miles. | Feet. | Miles. | Feet. | Miles. |
| 1·1 | 1 | 390 | 21 | 1487 | 41 | 3293 | 61 | 9032 | 101 | 17608 | 141 |
| 3·5 | 2 | 428 | 22 | 1561 | 42 | 3513 | 63 | 9393 | 103 | 18111 | 143 |
| 8·0 | 3 | 468 | 23 | 1636 | 43 | 3740 | 65 | 9760 | 105 | 18622 | 145 |
| 14·2 | 4 | 510 | 24 | 1713 | 44 | 3974 | 67 | 10135 | 107 | 19140 | 147 |
| 22·1 | 5 | 550 | 25 | 1792 | 45 | 4213 | 69 | 10518 | 109 | 19664 | 149 |
| 31·9 | 6 | 598 | 26 | 1872 | 46 | 4461 | 71 | 10908 | 111 | 20197 | 151 |
| 43·3 | 7 | 645 | 27 | 1954 | 47 | 4716 | 73 | 11304 | 113 | 20736 | 153 |
| 56·6 | 8 | 694 | 28 | 2039 | 48 | 4976 | 75 | 11709 | 115 | 21282 | 155 |
| 71·7 | 9 | 744 | 29 | 2124 | 49 | 5249 | 77 | 12120 | 117 | 21836 | 157 |
| 88·5 | 10 | 797 | 30 | 2212 | 50 | 5524 | 79 | 12538 | 119 | 22397 | 159 |
| 107 | 11 | 850 | 31 | 2301 | 51 | 5808 | 81 | 12966 | 121 | 22964 | 161 |
| 127 | 12 | 906 | 32 | 2393 | 52 | 6098 | 83 | 13397 | 123 | 23540 | 163 |
| 149 | 13 | 964 | 33 | 2485 | 53 | 6394 | 85 | 13836 | 125 | 24121 | 165 |
| 173 | 14 | 1023 | 34 | 2581 | 54 | 6700 | 87 | 14282 | 127 | 24711 | 167 |
| 199 | 15 | 1084 | 35 | 2677 | 55 | 7012 | 89 | 14737 | 129 | 25307 | 169 |
| 226 | 16 | 1147 | 36 | 2775 | 56 | 7332 | 91 | 15197 | 131 | 25911 | 171 |
| 256 | 17 | 1211 | 37 | 2875 | 57 | 7656 | 93 | 15664 | 133 | 26521 | 173 |
| 287 | 18 | 1278 | 38 | 2977 | 58 | 7987 | 95 | 16139 | 135 | 27139 | 175 |
| 319 | 19 | 1346 | 39 | 3081 | 59 | 8330 | 97 | 16622 | 137 | 27764 | 177 |
| 354 | 20 | 1416 | 40 | 3186 | 60 | 8678 | 99 | 17111 | 139 | 28396 | 179 |

(*Approximately* the distance visible in miles is the square root of the height in feet, an accidental relation easy to remember.)

* The effects of refraction at low angles are very variable, but in ordinary cases, if the height of observer be supposed to be increased by one-third, the distance of the visible sea horizon will not exceed the tabular value corresponding to the revised entry. Extraordinary cases are those of mirage, &c., for which no general rule can be given.

## TABLE X.

Values of $\dfrac{2 \operatorname{Sin}^2 \frac{1}{2} \text{ hour} \angle}{\operatorname{Sin} 1''}$.

| Seconds. | Hour Angles in Time. | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0m | 1m | 2m | 3m | 4m | 5m | 6m | 7m | 8m | 9m | 10m | 11m | 12m | 13m | 14m | 15m | 16m | 17m | 18m | 19m |
| 0 | 0 | 2 | 8 | 18 | 31 | 49 | 71 | 96 | 126 | 159 | 196 | 237 | 283 | 332 | 385 | 442 | 502 | 567 | 636 | 708 |
| 1 | 0 | 2 | 8 | 18 | 32 | 49 | 71 | 97 | 126 | 160 | 197 | 238 | 283 | 333 | 386 | 443 | 503 | 568 | 637 | 710 |
| 2 | 0 | 2 | 8 | 18 | 32 | 50 | 71 | 97 | 127 | 160 | 198 | 239 | 284 | 333 | 387 | 444 | 505 | 569 | 638 | 711 |
| 3 | 0 | 2 | 8 | 18 | 32 | 50 | 72 | 98 | 127 | 161 | 198 | 240 | 285 | 334 | 387 | 445 | 506 | 570 | 639 | 712 |
| 4 | 0 | 2 | 8 | 18 | 32 | 50 | 72 | 98 | 128 | 161 | 199 | 240 | 286 | 335 | 388 | 446 | 507 | 572 | 641 | 713 |
| 5 | 0 | 2 | 8 | 19 | 33 | 51 | 73 | 98 | 128 | 162 | 200 | 241 | 287 | 336 | 389 | 446 | 508 | 573 | 642 | 715 |
| 6 | 0 | 2 | 9 | 19 | 33 | 51 | 73 | 99 | 129 | 163 | 200 | 242 | 287 | 337 | 390 | 447 | 509 | 574 | 643 | 716 |
| 7 | 0 | 2 | 9 | 19 | 33 | 51 | 73 | 99 | 129 | 163 | 201 | 243 | 288 | 338 | 391 | 448 | 510 | 575 | 644 | 717 |
| 8 | 0 | 2 | 9 | 19 | 33 | 52 | 74 | 100 | 130 | 164 | 202 | 243 | 289 | 339 | 392 | 449 | 511 | 576 | 645 | 718 |
| 9 | 0 | 3 | 9 | 19 | 34 | 52 | 74 | 100 | 130 | 164 | 202 | 244 | 290 | 339 | 393 | 450 | 512 | 577 | 646 | 720 |
| 10 | 0 | 3 | 9 | 20 | 34 | 52 | 75 | 101 | 131 | 165 | 203 | 245 | 291 | 340 | 394 | 451 | 513 | 578 | 648 | 721 |
| 11 | 0 | 3 | 9 | 20 | 34 | 53 | 75 | 101 | 131 | 166 | 204 | 245 | 291 | 341 | 395 | 452 | 514 | 579 | 649 | 722 |
| 12 | 0 | 3 | 9 | 20 | 35 | 53 | 75 | 102 | 132 | 166 | 204 | 246 | 292 | 342 | 396 | 453 | 515 | 581 | 650 | 723 |
| 13 | 0 | 3 | 10 | 20 | 35 | 53 | 76 | 102 | 133 | 167 | 205 | 247 | 293 | 343 | 397 | 454 | 516 | 582 | 651 | 725 |
| 14 | 0 | 3 | 10 | 20 | 35 | 54 | 76 | 103 | 133 | 167 | 206 | 248 | 294 | 344 | 398 | 455 | 517 | 583 | 652 | 726 |
| 15 | 0 | 3 | 10 | 21 | 35 | 54 | 77 | 103 | 134 | 168 | 206 | 248 | 295 | 345 | 399 | 456 | 518 | 584 | 654 | 727 |
| 16 | 0 | 3 | 10 | 21 | 36 | 54 | 77 | 104 | 134 | 169 | 207 | 249 | 295 | 345 | 399 | 457 | 519 | 585 | 655 | 728 |
| 17 | 0 | 3 | 10 | 21 | 36 | 55 | 77 | 104 | 135 | 169 | 208 | 250 | 296 | 346 | 400 | 458 | 520 | 586 | 656 | 730 |
| 18 | 0 | 3 | 10 | 21 | 36 | 55 | 78 | 105 | 135 | 170 | 208 | 251 | 297 | 347 | 401 | 459 | 521 | 587 | 657 | 731 |
| 19 | 0 | 3 | 10 | 22 | 37 | 55 | 78 | 105 | 136 | 170 | 209 | 251 | 298 | 348 | 402 | 461 | 522 | 588 | 658 | 732 |
| 20 | 0 | 3 | 11 | 22 | 37 | 56 | 79 | 106 | 136 | 171 | 210 | 252 | 299 | 349 | 403 | 461 | 524 | 590 | 660 | 733 |
| 21 | 0 | 4 | 11 | 22 | 37 | 56 | 79 | 106 | 137 | 172 | 210 | 253 | 299 | 350 | 404 | 463 | 525 | 591 | 661 | 735 |
| 22 | 0 | 4 | 11 | 22 | 37 | 56 | 80 | 107 | 137 | 172 | 211 | 254 | 300 | 351 | 405 | 463 | 526 | 592 | 662 | 736 |
| 23 | 0 | 4 | 11 | 22 | 38 | 57 | 80 | 107 | 138 | 173 | 212 | 254 | 301 | 352 | 406 | 464 | 527 | 593 | 663 | 737 |
| 24 | 0 | 4 | 11 | 23 | 38 | 57 | 80 | 107 | 138 | 173 | 212 | 255 | 302 | 352 | 407 | 465 | 528 | 594 | 664 | 738 |
| 25 | 0 | 4 | 11 | 23 | 38 | 58 | 81 | 108 | 139 | 174 | 213 | 256 | 303 | 353 | 408 | 466 | 529 | 595 | 666 | 740 |
| 26 | 0 | 4 | 12 | 23 | 39 | 58 | 81 | 108 | 140 | 175 | 214 | 257 | 303 | 354 | 409 | 467 | 530 | 596 | 667 | 741 |
| 27 | 0 | 4 | 12 | 23 | 39 | 58 | 82 | 109 | 140 | 175 | 214 | 257 | 304 | 355 | 410 | 468 | 531 | 598 | 668 | 742 |
| 28 | 0 | 4 | 12 | 24 | 39 | 59 | 82 | 109 | 141 | 176 | 215 | 258 | 305 | 356 | 411 | 470 | 532 | 599 | 669 | 744 |

## TABLE X.—(*continued*).

| Seconds. | Hour Angles in Time. | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0m | 1m | 2m | 3m | 4m | 5m | 6m | 7m | 8m | 9m | 10m | 11m | 12m | 13m | 14m | 15m | 16m | 17m | 18m | 19m |
| 29 | 0 | 4 | 12 | 24 | 39 | 59 | 82 | 110 | 141 | 177 | 216 | 259 | 306 | 357 | 412 | 470 | 533 | 600 | 670 | 745 |
| 30 | 1 | 4 | 12 | 24 | 40 | 59 | 83 | 110 | 142 | 177 | 216 | 260 | 307 | 358 | 413 | 471 | 534 | 601 | 672 | 746 |
| 31 | 1 | 4 | 12 | 24 | 40 | 60 | 83 | 111 | 142 | 178 | 217 | 260 | 307 | 359 | 414 | 473 | 535 | 602 | 673 | 747 |
| 32 | 1 | 5 | 13 | 24 | 40 | 60 | 84 | 111 | 143 | 178 | 218 | 261 | 308 | 359 | 415 | 474 | 536 | 603 | 674 | 749 |
| 33 | 1 | 5 | 13 | 25 | 41 | 60 | 84 | 112 | 143 | 179 | 218 | 262 | 309 | 360 | 415 | 475 | 538 | 604 | 675 | 750 |
| 34 | 1 | 5 | 13 | 25 | 41 | 61 | 85 | 112 | 144 | 180 | 219 | 263 | 310 | 361 | 416 | 476 | 539 | 606 | 676 | 751 |
| 35 | 1 | 5 | 13 | 25 | 41 | 61 | 85 | 113 | 145 | 180 | 220 | 263 | 311 | 362 | 417 | 477 | 540 | 607 | 678 | 753 |
| 36 | 1 | 5 | 13 | 25 | 41 | 62 | 85 | 113 | 145 | 181 | 221 | 264 | 312 | 363 | 418 | 478 | 541 | 608 | 679 | 754 |
| 37 | 1 | 5 | 13 | 26 | 42 | 62 | 86 | 114 | 146 | 182 | 221 | 265 | 312 | 364 | 419 | 479 | 542 | 609 | 680 | 755 |
| 38 | 1 | 5 | 14 | 26 | 42 | 62 | 86 | 114 | 146 | 182 | 222 | 266 | 313 | 365 | 420 | 480 | 543 | 610 | 681 | 756 |
| 39 | 1 | 5 | 14 | 26 | 42 | 63 | 87 | 115 | 147 | 183 | 223 | 266 | 314 | 366 | 421 | 481 | 544 | 611 | 683 | 758 |
| 40 | 1 | 5 | 14 | 26 | 43 | 63 | 87 | 115 | 147 | 183 | 223 | 267 | 315 | 367 | 422 | 482 | 545 | 612 | 684 | 759 |
| 41 | 1 | 6 | 14 | 27 | 43 | 63 | 88 | 116 | 148 | 184 | 224 | 268 | 316 | 367 | 423 | 483 | 546 | 614 | 685 | 760 |
| 42 | 1 | 6 | 14 | 27 | 43 | 64 | 88 | 116 | 149 | 185 | 225 | 269 | 317 | 368 | 424 | 484 | 547 | 615 | 686 | 761 |
| 43 | 1 | 6 | 14 | 27 | 44 | 64 | 89 | 117 | 149 | 185 | 225 | 269 | 317 | 369 | 425 | 485 | 548 | 616 | 687 | 763 |
| 44 | 1 | 6 | 15 | 27 | 44 | 64 | 89 | 117 | 150 | 186 | 226 | 270 | 318 | 370 | 426 | 486 | 549 | 617 | 689 | 764 |
| 45 | 1 | 6 | 15 | 28 | 44 | 65 | 89 | 118 | 150 | 187 | 227 | 271 | 319 | 371 | 427 | 487 | 551 | 618 | 690 | 765 |
| 46 | 1 | 6 | 15 | 28 | 45 | 65 | 90 | 118 | 151 | 187 | 228 | 272 | 320 | 372 | 428 | 488 | 552 | 619 | 691 | 767 |
| 47 | 1 | 6 | 15 | 28 | 45 | 66 | 90 | 119 | 151 | 188 | 228 | 273 | 321 | 373 | 429 | 489 | 553 | 621 | 692 | 768 |
| 48 | 1 | 6 | 15 | 28 | 45 | 66 | 91 | 119 | 152 | 188 | 229 | 273 | 322 | 374 | 430 | 490 | 554 | 622 | 694 | 769 |
| 49 | 1 | 6 | 16 | 29 | 45 | 66 | 91 | 120 | 153 | 189 | 230 | 274 | 322 | 375 | 431 | 491 | 555 | 623 | 695 | 771 |
| 50 | 1 | 7 | 16 | 29 | 46 | 67 | 92 | 120 | 153 | 190 | 230 | 275 | 323 | 376 | 432 | 492 | 556 | 624 | 696 | 772 |
| 51 | 1 | 7 | 16 | 29 | 46 | 67 | 92 | 121 | 154 | 190 | 231 | 276 | 324 | 376 | 433 | 493 | 557 | 625 | 697 | 773 |
| 52 | 2 | 7 | 16 | 29 | 46 | 68 | 93 | 121 | 154 | 191 | 232 | 276 | 325 | 377 | 434 | 494 | 558 | 626 | 698 | 774 |
| 53 | 2 | 7 | 16 | 30 | 47 | 68 | 93 | 122 | 155 | 192 | 232 | 277 | 326 | 378 | 435 | 495 | 559 | 628 | 700 | 776 |
| 54 | 2 | 7 | 16 | 30 | 47 | 68 | 93 | 122 | 155 | 192 | 233 | 278 | 327 | 379 | 435 | 496 | 560 | 629 | 701 | 777 |
| 55 | 2 | 7 | 17 | 30 | 47 | 69 | 94 | 123 | 156 | 193 | 234 | 279 | 327 | 380 | 437 | 497 | 562 | 630 | 702 | 778 |
| 56 | 2 | 7 | 17 | 30 | 48 | 69 | 94 | 124 | 157 | 194 | 235 | 279 | 328 | 381 | 438 | 498 | 563 | 631 | 703 | 780 |
| 57 | 2 | 7 | 17 | 31 | 48 | 69 | 95 | 124 | 157 | 194 | 235 | 280 | 329 | 382 | 439 | 499 | 564 | 632 | 705 | 781 |
| 58 | 2 | 8 | 17 | 31 | 48 | 70 | 95 | 125 | 158 | 195 | 236 | 281 | 330 | 383 | 440 | 500 | 565 | 633 | 706 | 782 |
| 59 | 2 | 8 | 17 | 31 | 49 | 70 | 96 | 125 | 158 | 196 | 237 | 282 | 331 | 384 | 441 | 501 | 566 | 635 | 707 | 784 |

## TABLE XI.

NUMBER OF GEOGRAPHICAL MILES,* OR MINUTES OF THE EQUATOR CONTAINED IN A DEGREE OF LONGITUDE UNDER EACH PARALLEL OF LATITUDE, ON THE SUPPOSITION OF THE EARTH'S SPHEROIDAL SHAPE WITH A COMPRESSION OF $\frac{1}{304}$.

| Parallel of Latitude. | Length of Degree. | Parallel of Latitude. | Length of Degree. | Parallel of Latitude. | Length of Degree. | Parallel of Latitude. | Length of Degree. | Parallel of Latitude. | Length of Degree. | Parallel of Latitude. | Length of Degree. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ° | ′ | ° | ′ | ° | ′ | ° | ′ | ° | ′ | ° | ′ |
| 0 | 60·000 | 16 | 57·690 | 31 | 51·475 | 46 | 41·750 | 61 | 29·161 | 76 | 14·560 |
| 1 | 59·991 | 17 | 57·394 | 32 | 50·930 | 47 | 40·992 | 62 | 28·240 | 77 | 13·539 |
| 2 | 59·964 | 18 | 57·081 | 33 | 50·370 | 48 | 40·220 | 63 | 27·310 | 78 | 12·514 |
| 3 | 59·918 | 19 | 56·751 | 34 | 49·793 | 49 | 39·437 | 64 | 26·372 | 79 | 11·485 |
| 4 | 59·8 | 20 | 56·403 | 35 | 49·202 | 50 | 38·642 | 65 | 25·426 | 80 | 10·452 |
| 5 | 59·773 | 21 | 56·038 | 36 | 48·596 | 51 | 37·834 | 66 | 24·471 | 81 | 9·416 |
| 6 | 59·673 | 22 | 55·657 | 37 | 47·975 | 52 | 37·015 | 67 | 23·509 | 82 | 8·377 |
| 7 | 59·556 | 23 | 55·258 | 38 | 47·339 | 53 | 36·185 | 68 | 22·540 | 83 | 7·336 |
| 8 | 59·419 | 24 | 54·842 | 39 | 46·688 | 54 | 35·343 | 69 | 21·564 | 84 | 6·292 |
| 9 | 59·266 | 25 | 54·410 | 40 | 46·021 | 55 | 34·490 | 70 | 20·581 | 85 | 5·246 |
| 10 | 59·094 | 26 | 53·962 | 41 | 45·346 | 56 | 33·627 | 71 | 19·592 | 86 | 4·199 |
| 11 | 58·905 | 27 | 53·496 | 42 | 44·654 | 57 | 32·754 | 72 | 18·596 | 87 | 3·150 |
| 12 | 58·697 | 28 | 53·015 | 43 | 43·948 | 58 | 31·870 | 73 | 17·595 | 88 | 2·101 |
| 13 | 58·472 | 29 | 52·518 | 44 | 43·229 | 59 | 30·977 | 74 | 16·588 | 89 | 1·050 |
| 14 | 58·229 | 30 | 52·004 | 45 | 42·495 | 60 | 30·074 | 75 | 15·577 | 90 | 0·000 |
| 15 | 57·968 | | | | | | | | | | |

* To convert to Statute miles, multiply by 1·15.

## TABLE XII.

### Table for converting Statute into Geographical Miles.

| Stat. Miles. | Geo. Miles. | Stat. Miles. | Geo. Miles. | Stat. Miles. | Geo. Miles. | Stat. Miles. | Geo. Miles. |
|---|---|---|---|---|---|---|---|
| 1·00 | 0·87 | 13·25 | 11·50 | 25·50 | 22·11 | 37·75 | 32·78 |
| 1·25 | 1·08 | 13·50 | 11·72 | 25·75 | 22·36 | 38·00 | 33·00 |
| 1·50 | 1·30 | 13·75 | 11·94 | 26·00 | 22·58 | 38·25 | 33·21 |
| 1·75 | 1·52 | 14·00 | 12·16 | 26·25 | 22·80 | 38·50 | 33·43 |
| 2·00 | 1·74 | 14·25 | 12·37 | 26·50 | 23·01 | 38·75 | 33·65 |
| 2·25 | 1·95 | 14·50 | 12·59 | 26·75 | 23·23 | 39·00 | 33·87 |
| 2·50 | 2·17 | 14·75 | 12·81 | 27·00 | 23·45 | 39·25 | 34·08 |
| 2·75 | 2·39 | 15·00 | 13·03 | 27·25 | 23·66 | 39·50 | 34·30 |
| 3·00 | 2·60 | 15·25 | 13·24 | 27·50 | 23·88 | 39·75 | 34·52 |
| 3·25 | 2·82 | 15·50 | 13·56 | 27·75 | 24·10 | 40·00 | 34·73 |
| 3·50 | 3·04 | 15·75 | 13·68 | 28 00 | 24·31 | 40·25 | 34·95 |
| 3·75 | 3·26 | 16·00 | 13·89 | 28·25 | 24·53 | 40·50 | 35·17 |
| 4·00 | 3·48 | 16·25 | 14·11 | 28·50 | 24·75 | 40·75 | 35·38 |
| 4·25 | 3·70 | 16·50 | 14·33 | 28·75 | 24·97 | 41·00 | 35·60 |
| 4·50 | 3·91 | 16·75 | 14·55 | 29·00 | 25·18 | 41·25 | 35·82 |
| 4·75 | 4·12 | 17·00 | 14·76 | 29·25 | 25·40 | 41·50 | 36·04 |
| 5·00 | 4·34 | 17·25 | 14·98 | 29·50 | 25·64 | 41·75 | 36·25 |
| 5·25 | 4·56 | 17·50 | 15·20 | 29·75 | 25·83 | 42·00 | 36·47 |
| 5·50 | 4·78 | 17·75 | 15·41 | 30·00 | 26·05 | 42·25 | 36·69 |
| 5·75 | 4·99 | 18·00 | 15·63 | 30·25 | 26·27 | 42·50 | 36·90 |
| 6·00 | 5·21 | 18·25 | 15·85 | 30·50 | 26·48 | 42·75 | 37·12 |
| 6·25 | 5·43 | 18·50 | 16·06 | 30·75 | 26·70 | 43·00 | 37·34 |
| 6·50 | 5·64 | 18·75 | 16·28 | 31·00 | 26·92 | 43·25 | 37·55 |
| 6·75 | 5·86 | 19·00 | 16·50 | 31·25 | 27·13 | 43·50 | 37·77 |
| 7·00 | 6·08 | 19·25 | 16·72 | 31·50 | 27·35 | 43·75 | 37·99 |
| 7·25 | 6·30 | 19·50 | 16·93 | 31·75 | 27·57 | 44·00 | 38·21 |
| 7·50 | 6·51 | 19·75 | 17·15 | 32·00 | 27·79 | 44·25 | 38·42 |
| 7·75 | 6·73 | 20·00 | 17·37 | 32·25 | 28·01 | 44·50 | 38·64 |
| 8·00 | 6·95 | 20·25 | 17·58 | 32·50 | 28·22 | 44·75 | 38·86 |
| 8·25 | 7·16 | 20·50 | 17·80 | 32·75 | 28·44 | 45·00 | 39·07 |
| 8·50 | 7·38 | 20·75 | 18·02 | 33·00 | 28·66 | 45·25 | 39·29 |
| 8·75 | 7·60 | 21·00 | 18·24 | 33·25 | 28·87 | 45·50 | 39·51 |
| 9·00 | 7·81 | 21·25 | 18·45 | 33·50 | 29·09 | 45·75 | 39·72 |
| 9·25 | 8·03 | 21·50 | 18·67 | 33·75 | 29·31 | 46·00 | 39·94 |
| 9·50 | 8·25 | 21·75 | 18·89 | 34·00 | 29·53 | 46·25 | 40·16 |
| 9·75 | 8·47 | 22·00 | 19·10 | 34·25 | 29·74 | 46·50 | 40·38 |
| 10·00 | 8·68 | 22·25 | 19·32 | 34·50 | 29·96 | 46·75 | 40·59 |
| 10·25 | 8·90 | 22·50 | 19·54 | 34·75 | 30·18 | 47·00 | 40·81 |
| 10·50 | 9·12 | 22·75 | 19·76 | 35·00 | 30·39 | 47·25 | 41·03 |
| 10·75 | 9·33 | 23·00 | 19·97 | 35·25 | 30·61 | 47·50 | 41·24 |
| 11·00 | 9·55 | 23·25 | 20·19 | 35·50 | 30·83 | 47·75 | 41·46 |
| 11·25 | 9·77 | 23·50 | 20·41 | 35·75 | 31·04 | 48·00 | 41·68 |
| 11·50 | 9·99 | 23·75 | 20·62 | 36·00 | 31·26 | 48·25 | 41·89 |
| 11·75 | 10·20 | 24·00 | 20·34 | 36·25 | 31·48 | 48·50 | 42·11 |
| 12·00 | 10·42 | 24·25 | 21·06 | 36·50 | 31·70 | 48·75 | 42·33 |
| 12·25 | 10·64 | 24·50 | 21·28 | 36·75 | 31·91 | 49·00 | 42·55 |
| 12·50 | 10·85 | 24·75 | 21·49 | 37·00 | 32·13 | 49·25 | 42·76 |
| 12·75 | 11·07 | 25·00 | 21·71 | 37·25 | 32·35 | 49·50 | 42·98 |
| 13·00 | 11·29 | 25·25 | 21·93 | 37·50 | 32·56 | 49·75 | 43·20 |
| | | | | | | 50·00 | 43·42 |

## TABLE XIII.

### For converting Geographical into Statute Miles.

| Geo. Miles. | Stat. Miles. | Geo. Miles. | Stat. Miles. | Geo. Miles. | Stat. Miles. | Geo. Miles. | Stat. Miles. |
|---|---|---|---|---|---|---|---|
| 1·00 | 1·15 | 13·25 | 15·26 | 25·50 | 29·36 | 37·75 | 43·34 |
| 1·25 | 1·44 | 13·50 | 15·54 | 25·75 | 29·66 | 38·00 | 43·63 |
| 1·50 | 1·73 | 13·75 | 15·83 | 26·00 | 29·94 | 38·25 | 43·92 |
| 1·75 | 2·01 | 14·00 | 16·12 | 26·25 | 30·23 | 38·50 | 44·20 |
| 2·00 | 2·30 | 14·25 | 16·41 | 26·50 | 30·52 | 38·75 | 44·49 |
| 2·25 | 2·59 | 14·50 | 16·70 | 26·75 | 30·81 | 39·00 | 44·78 |
| 2·50 | 2·88 | 14·75 | 16·98 | 27·00 | 31·09 | 39·25 | 45·07 |
| 2·75 | 3·17 | 15·00 | 17·27 | 27·25 | 31·38 | 39·50 | 45·35 |
| 3·00 | 3·45 | 15·25 | 17·56 | 27·50 | 31·67 | 39·75 | 45·64 |
| 3·25 | 3·74 | 15·50 | 17·85 | 27·75 | 31·95 | 40·00 | 45·93 |
| 3·50 | 4·03 | 15·75 | 18·14 | 28·00 | 32·24 | 40·25 | 46·21 |
| 3·75 | 4·32 | 16·00 | 18·42 | 28·25 | 32·53 | 40·50 | 46·50 |
| 4·00 | 4·61 | 16·25 | 18·71 | 28·50 | 32·81 | 40·75 | 46·79 |
| 4·25 | 4·89 | 16·50 | 19·00 | 28·75 | 33·10 | 41·00 | 47·07 |
| 4·50 | 5·18 | 16·75 | 19·28 | 29·00 | 33·39 | 41·25 | 47·36 |
| 4·75 | 5·47 | 17·00 | 19·57 | 29·25 | 33·68 | 41·50 | 47·66 |
| 5·00 | 5·76 | 17·25 | 19·86 | 29·50 | 33·96 | 41·75 | 47·95 |
| 5·25 | 6·04 | 17·50 | 20·15 | 29·75 | 34·25 | 42·00 | 48·23 |
| 5·50 | 6·33 | 17·75 | 20·44 | 30·00 | 34·54 | 42·25 | 48·52 |
| 5·75 | 6·62 | 18·00 | 20·73 | 30·25 | 34·82 | 42·50 | 48·81 |
| 6·00 | 6·91 | 18·25 | 21·01 | 30·50 | 35·11 | 42·75 | 49·09 |
| 6·25 | 7·20 | 18·50 | 21·30 | 30·75 | 35·40 | 43·00 | 49·38 |
| 6·50 | 7·48 | 18·75 | 21·59 | 31·00 | 35·68 | 43·25 | 49·67 |
| 6·75 | 7·77 | 19·00 | 21·88 | 31·25 | 35·97 | 43·50 | 49·95 |
| 7·00 | 8·06 | 19·25 | 22·17 | 31·50 | 36·26 | 43·75 | 50·24 |
| 7·25 | 8·35 | 19·50 | 22·45 | 31·75 | 36·55 | 44·00 | 50·33 |
| 7·50 | 8·64 | 19·75 | 22·74 | 32·00 | 36·83 | 44·25 | 50·82 |
| 7·75 | 8·92 | 20·00 | 23·03 | 32·25 | 37·12 | 44·50 | 51·10 |
| 8·00 | 9·21 | 20·25 | 23·32 | 32·50 | 37·41 | 44·75 | 51·39 |
| 8·25 | 9·50 | 20·50 | 23·61 | 32·75 | 37·69 | 45·00 | 51·68 |
| 8·50 | 9·79 | 20·75 | 23·89 | 33·00 | 37·98 | 45·25 | 51·96 |
| 8·75 | 10·07 | 21·00 | 24·18 | 33·25 | 38·27 | 45·50 | 52·25 |
| 9·00 | 10·36 | 21·25 | 24·47 | 33·50 | 38·55 | 45·75 | 52·54 |
| 9·25 | 10·65 | 21·50 | 24·76 | 33·75 | 38·84 | 46·00 | 52·83 |
| 9·50 | 10·94 | 21·75 | 25·04 | 34·00 | 39·13 | 46·25 | 53·11 |
| 9·75 | 11·23 | 22·00 | 25·33 | 34·25 | 39·42 | 46·50 | 53·40 |
| 10·00 | 11·51 | 22·25 | 25·62 | 34·50 | 39·70 | 46·75 | 53·69 |
| 10·25 | 11·80 | 22·50 | 25·91 | 34·75 | 39·99 | 47·00 | 53·97 |
| 10·50 | 12·09 | 22·75 | 26·20 | 35·00 | 40·28 | 47·25 | 54·26 |
| 10·75 | 12·38 | 23·00 | 26·48 | 35·25 | 40·56 | 47·50 | 54·49 |
| 11·00 | 12·67 | 23·25 | 26·77 | 35·50 | 40·85 | 47·75 | 54·83 |
| 11·25 | 12·95 | 23·50 | 27·06 | 35·75 | 41·13 | 48·00 | 55·12 |
| 11·50 | 13·24 | 23·75 | 27·35 | 36·00 | 41·42 | 48·25 | 55·41 |
| 11·75 | 13·53 | 24·00 | 27·64 | 36·25 | 41·72 | 48·50 | 55·70 |
| 12·00 | 13·82 | 24·25 | 27·92 | 36·50 | 42·01 | 48·75 | 55·98 |
| 12·25 | 14·11 | 24·50 | 28·21 | 36·75 | 42·30 | 49·00 | 56·27 |
| 12·50 | 14·39 | 24·75 | 28·50 | 37·00 | 42·58 | 49·25 | 56·56 |
| 12·75 | 14·68 | 25·00 | 28·79 | 37·25 | 42·77 | 49·50 | 56·84 |
| 13·00 | 14·97 | 25·25 | 29·07 | 37·50 | 43·06 | 49·75 | 57·13 |
| | | | | | | 50·00 | 57·42 |

# TABLE XIV.

## Comparison of Thermometer Scales.

| Fahrenheit. | Réaumur. | Centigrade. | Fahrenheit. | Réaumur. | Centigrade. | Fahrenheit. | Réaumur. | Centigrade. |
|---|---|---|---|---|---|---|---|---|
| ° | ° | ° | ° | ° | ° | ° | ° | ° |
| | | | 33 | +0·4 | + 0·6 | 67 | +15·6 | +19·4 |
| 0 | −14·2 | −17·8 | 34 | 0·9 | 1·1 | 68 | 16·0 | 20·0 |
| 1 | 13·8 | 17·2 | 35 | 1·3 | 1·7 | 69 | 16·4 | 20·6 |
| 2 | 13·3 | 16·7 | 36 | 1·8 | 2·2 | 70 | 16·9 | 21·1 |
| 3 | 12·9 | 16·1 | 37 | 2·2 | 2·8 | 71 | 17·3 | 21·7 |
| 4 | 12·4 | 15·6 | 38 | 2·7 | 3·3 | 72 | 17·8 | 22·2 |
| 5 | 12·0 | 15·0 | 39 | 3·1 | 3·9 | 73 | 18·2 | 22·8 |
| 6 | 11·6 | 14·4 | 40 | 3·6 | 4·4 | 74 | 18·7 | 23·3 |
| 7 | 11·1 | 13·9 | 41 | 4·0 | 5·0 | 75 | 19·1 | 23·9 |
| 8 | 10·7 | 13·3 | 42 | 4·4 | 5·6 | 76 | 19·6 | 24·4 |
| 9 | 10·2 | 12·8 | 43 | 4·9 | 6·1 | 77 | 20·0 | 25·0 |
| 10 | 9·8 | 12·2 | 44 | 5·3 | 6·7 | 78 | 20·4 | 25·6 |
| 11 | 9·3 | 11·7 | 45 | 5·8 | 7·2 | 79 | 20·9 | 26·1 |
| 12 | 8·9 | 11·1 | 46 | 6·2 | 7·8 | 80 | 21·3 | 26·7 |
| 13 | 8·4 | 10·6 | 47 | 6·7 | 8·3 | 81 | 21·8 | 27·2 |
| 14 | 8·0 | 10·0 | 48 | 7·1 | 8·9 | 82 | 22·2 | 27·8 |
| 15 | 7·6 | 9·4 | 49 | 7·6 | 9·4 | 83 | 22·7 | 28·3 |
| 16 | 7·1 | 8·9 | 50 | 8·0 | 10·0 | 84 | 23·1 | 28·9 |
| 17 | 6·7 | 8·3 | 51 | 8·4 | 10·6 | 85 | 23·6 | 29·4 |
| 18 | 6·2 | 7·8 | 52 | 8·9 | 11·1 | 86 | 24·0 | 30·0 |
| 19 | 5·8 | 7·2 | 53 | 9·3 | 11·7 | 87 | 24·4 | 30·6 |
| 20 | 5·3 | 6·7 | 54 | 9·8 | 12·2 | 88 | 24·9 | 31·1 |
| 21 | 4·9 | 6·1 | 55 | 10·2 | 12·8 | 89 | 25·3 | 31·7 |
| 22 | 4·4 | 5·6 | 56 | 10·7 | 13·3 | 90 | 25·8 | 32·2 |
| 23 | 4·0 | 5·0 | 57 | 11·1 | 13·9 | 91 | 26·2 | 32·8 |
| 24 | 3·6 | 4·4 | 58 | 11·6 | 14·4 | 92 | 26·7 | 33·3 |
| 25 | 3·1 | 3·9 | 59 | 12·0 | 15·0 | 93 | 27·1 | 33·9 |
| 26 | 2·7 | 3·3 | 60 | 12·4 | 15·6 | 94 | 27·6 | 34·4 |
| 27 | 2·2 | 2·8 | 61 | 12·9 | 16·1 | 95 | 28·0 | 35·0 |
| 28 | 1·8 | 2·2 | 62 | 13·3 | 16·7 | 96 | 28·4 | 35·6 |
| 29 | 1·3 | 1·7 | 63 | 13·8 | 17·2 | 97 | 28·9 | 36·1 |
| 30 | 0·9 | 1·1 | 64 | 14·2 | 17·8 | 98 | 29·3 | 36·7 |
| 31 | −0·4 | −0·6 | 65 | 14·7 | 18·3 | 99 | 29·8 | 37·2 |
| 32 | 0·0 | 0·0 | 66 | +15·1 | +18·9 | 100 | +30·2 | +37·8 |

$x^\circ$ Réaumur $= (32^\circ + \frac{9}{4} x^\circ)$ Fahrenheit $= \frac{5}{4} x^\circ$ Centigrade.
$x^\circ$ Centigrade $= (32^\circ + \frac{9}{5} x^\circ)$ Fahrenheit $= \frac{4}{5} x^\circ$ Réaumur.
$x^\circ$ Fahrenheit $= \frac{4}{9} (x^\circ - 32)$ Réaumur $= \frac{5}{9} (x^\circ - 32^\circ)$ Centigrade.

## TABLE XV.

### For converting English Inches and Tenths into Millimètres.

| English inches and tenths. | Millim. | English inches and tenths. | Millim. | English inches and tenths. | Millim. | English inches and tenths. | Millim. | English inches and tenths. | Millim. |
|---|---|---|---|---|---|---|---|---|---|
| 12·0 | 304·79 | 16·0 | 406·39 | 20·0 | 507·99 | 24·0 | 609·59 | 28·0 | 711·19 |
| 1 | 307·33 | 1 | 408·93 | 1 | 510·53 | 1 | 612·13 | 1 | 713·73 |
| 2 | 309·87 | 2 | 411·47 | 2 | 513·07 | 2 | 614·67 | 2 | 716·27 |
| 3 | 312·41 | 3 | 414·01 | 3 | 515·61 | 3 | 617·21 | 3 | 718·81 |
| 4 | 314·95 | 4 | 416·55 | 4 | 518·15 | 4 | 619·75 | 4 | 721·35 |
| 5 | 317·49 | 5 | 419·09 | 5 | 520·69 | 5 | 622·29 | 5 | 723·89 |
| 6 | 320·03 | 6 | 421·63 | 6 | 523·23 | 6 | 624·83 | 6 | 726·43 |
| 7 | 322·57 | 7 | 424·17 | 7 | 525·77 | 7 | 627·37 | 7 | 728·97 |
| 8 | 325·11 | 8 | 426·71 | 8 | 528·31 | 8 | 629·91 | 8 | 731·51 |
| 9 | 327·65 | 9 | 429·25 | 9 | 530·85 | 9 | 632·45 | 9 | 734·05 |
| 13·0 | 330·19 | 17·0 | 431·79 | 21·0 | 533·39 | 25·0 | 634·99 | 29·0 | 736·59 |
| 1 | 332·73 | 1 | 434·33 | 1 | 535·93 | 1 | 637·53 | 1 | 739·13 |
| 2 | 335·27 | 2 | 436·87 | 2 | 538·47 | 2 | 640·07 | 2 | 741·67 |
| 3 | 337·81 | 3 | 439·41 | 3 | 541·01 | 3 | 642·61 | 3 | 744·21 |
| 4 | 340·35 | 4 | 441·95 | 4 | 543·55 | 4 | 645·15 | 4 | 746·75 |
| 5 | 342·89 | 5 | 444·49 | 5 | 546·09 | 5 | 647·69 | 5 | 749·29 |
| 6 | 345·43 | 6 | 447·03 | 6 | 548·63 | 6 | 650·23 | 6 | 751·83 |
| 7 | 347·97 | 7 | 449·57 | 7 | 551·17 | 7 | 652·77 | 7 | 754·37 |
| 8 | 350·51 | 8 | 452·11 | 8 | 553·71 | 8 | 655·31 | 8 | 756·91 |
| 9 | 353·05 | 9 | 454·65 | 9 | 556·25 | 9 | 657·85 | 9 | 759·45 |
| 14·0 | 355·59 | 18·0 | 457·19 | 22·0 | 558·79 | 26·0 | 660·39 | 30·0 | 761·99 |
| 1 | 358·13 | 1 | 459·73 | 1 | 561·33 | 1 | 662·93 | 1 | 764·53 |
| 2 | 360·67 | 2 | 462·27 | 2 | 563·87 | 2 | 665·47 | 2 | 767·07 |
| 3 | 363·21 | 3 | 464·81 | 3 | 566·41 | 3 | 668·01 | 3 | 769·61 |
| 4 | 365·75 | 4 | 467·35 | 4 | 568·95 | 4 | 670·55 | 4 | 772·15 |
| 5 | 368·29 | 5 | 469·89 | 5 | 571·49 | 5 | 673·09 | 5 | 774·69 |
| 6 | 370·83 | 6 | 472·43 | 6 | 574·03 | 6 | 675·63 | 6 | 777·23 |
| 7 | 373·37 | 7 | 474·97 | 7 | 576·57 | 7 | 678·17 | 7 | 779·77 |
| 8 | 375·91 | 8 | 477·51 | 8 | 579·11 | 8 | 680·71 | 8 | 782·31 |
| 9 | 378·45 | 9 | 480·05 | 9 | 581·65 | 9 | 683·25 | 9 | 784·85 |
| 15·0 | 380·99 | 19·0 | 482·59 | 23·0 | 584·19 | 27·0 | 685·79 | 31·0 | 787·39 |
| 1 | 383·53 | 1 | 485·13 | 1 | 586·73 | 1 | 688·33 | 1 | 789·93 |
| 2 | 386·07 | 2 | 487·67 | 2 | 589·27 | 2 | 690·87 | 2 | 792·47 |
| 3 | 388·61 | 3 | 490·21 | 3 | 591·81 | 3 | 693·41 | 3 | 795·01 |
| 4 | 391·15 | 4 | 492·75 | 4 | 594·35 | 4 | 695·95 | 4 | 797·55 |
| 5 | 393·69 | 5 | 495·29 | 5 | 596·89 | 5 | 698·49 | | |
| 6 | 396·23 | 6 | 497·83 | 6 | 599·43 | 6 | 701·03 | | |
| 7 | 398·77 | 7 | 500·37 | 7 | 601·97 | 7 | 703·57 | | |
| 8 | 401·31 | 8 | 502·91 | 8 | 604·51 | 8 | 706·11 | | |
| 9 | 403·85 | 9 | 505·45 | 9 | 607·05 | 9 | 708·65 | | |

### Parts to be added for Hundredths of an Inch.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| ·254 | ·508 | ·762 | 1·016 | 1·270 | 1·524 | 1·778 | 2·032 | 2·286 |

## TABLE XVI.

### CONVERSION OF MÈTRES INTO ENGLISH FEET.

### 1 to 210.

| Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3·28 | 36 | 118·11 | 71 | 232·94 | 106 | 347·78 | 141 | 462·61 | 176 | 577·44 |
| 2 | 6·56 | 37 | 121·39 | 72 | 236·22 | 7 | 351·06 | 42 | 465·89 | 77 | 580·72 |
| 3 | 9·84 | 38 | 124·67 | 73 | 239·51 | 8 | 354·34 | 43 | 469·17 | 78 | 584·00 |
| 4 | 13·12 | 39 | 127·96 | 74 | 242·79 | 9 | 357·62 | 44 | 472·45 | 79 | 587·28 |
| 5 | 16·40 | 40 | 131·24 | 75 | 246·07 | 10 | 360·90 | 45 | 475·73 | 80 | 590·56 |
| 6 | 19·69 | 41 | 134·52 | 76 | 249·35 | 111 | 364·18 | 146 | 479·01 | 181 | 593·84 |
| 7 | 22·97 | 42 | 137·80 | 77 | 252·63 | 12 | 367·46 | 47 | 482·29 | 82 | 597·12 |
| 8 | 26·25 | 43 | 141·08 | 78 | 255·91 | 13 | 370·74 | 48 | 485·57 | 83 | 600·40 |
| 9 | 29·53 | 44 | 144·36 | 79 | 259·19 | 14 | 374·02 | 49 | 488·85 | 84 | 603·69 |
| 10 | 32·81 | 45 | 147·64 | 80 | 262·47 | 15 | 377·30 | 50 | 492·13 | 85 | 606·97 |
| 11 | 36·09 | 46 | 150·92 | 81 | 265·75 | 116 | 380·58 | 151 | 495·42 | 186 | 610·25 |
| 12 | 39·37 | 47 | 154·20 | 82 | 269·03 | 17 | 383·87 | 52 | 498·70 | 87 | 613·53 |
| 13 | 42·65 | 48 | 157·48 | 83 | 272·31 | 18 | 387·15 | 53 | 501·98 | 88 | 616·81 |
| 14 | 45·93 | 49 | 160·76 | 84 | 275·60 | 19 | 390·43 | 54 | 505·26 | 89 | 620·09 |
| 15 | 49·21 | 50 | 164·04 | 85 | 278·88 | 20 | 393·71 | 55 | 508·54 | 90 | 623·37 |
| 16 | 52·49 | 51 | 167·33 | 86 | 282·16 | 121 | 396·99 | 156 | 511·82 | 191 | 626·65 |
| 17 | 55·78 | 52 | 170·61 | 87 | 285·44 | 22 | 400·27 | 57 | 515·10 | 92 | 629·93 |
| 18 | 59·06 | 53 | 173·89 | 88 | 288·72 | 23 | 403·55 | 58 | 518·38 | 93 | 633·21 |
| 19 | 62·34 | 54 | 177·17 | 89 | 292·00 | 24 | 406·83 | 59 | 521·66 | 94 | 636·49 |
| 20 | 65·62 | 55 | 180·45 | 90 | 295·28 | 25 | 410·11 | 60 | 524·94 | 95 | 639·78 |
| 21 | 68·90 | 56 | 183·73 | 91 | 298·56 | 126 | 413·39 | 161 | 528·22 | 196 | 643·06 |
| 22 | 72·18 | 57 | 187·01 | 92 | 301·84 | 27 | 416·67 | 62 | 531·51 | 97 | 646·34 |
| 23 | 75·46 | 58 | 190·29 | 93 | 305·12 | 28 | 419·96 | 63 | 534·79 | 98 | 649·62 |
| 24 | 78·74 | 59 | 193·57 | 94 | 308·40 | 29 | 423·24 | 64 | 538·07 | 99 | 652·90 |
| 25 | 82·02 | 60 | 196·85 | 95 | 311·69 | 30 | 426·52 | 65 | 541·35 | 200 | 656·18 |
| 26 | 85·30 | 61 | 200·13 | 96 | 314·97 | 131 | 429·80 | 166 | 544·63 | 201 | 659·46 |
| 27 | 88·58 | 62 | 203·42 | 97 | 318·25 | 32 | 433·08 | 67 | 547·91 | 2 | 662·74 |
| 28 | 91·87 | 63 | 206·70 | 98 | 321·53 | 33 | 436·36 | 68 | 551·19 | 3 | 666·02 |
| 29 | 95·15 | 64 | 209·98 | 99 | 324·81 | 34 | 439·64 | 69 | 554·47 | 4 | 669·30 |
| 30 | 98·43 | 65 | 213·26 | 100 | 328·09 | 35 | 442·92 | 70 | 557·75 | 5 | 672·58 |
| 31 | 101·71 | 66 | 216·54 | 101 | 331·37 | 136 | 446·20 | 171 | 561·03 | 206 | 675·87 |
| 32 | 104·99 | 67 | 219·82 | 2 | 334·65 | 37 | 449·48 | 72 | 564·31 | 7 | 679·15 |
| 33 | 108·27 | 68 | 223·10 | 3 | 337·93 | 38 | 452·76 | 73 | 567·60 | 8 | 682·43 |
| 34 | 111·55 | 69 | 226·38 | 4 | 341·21 | 39 | 456·04 | 74 | 570·88 | 9 | 685·71 |
| 35 | 114·83 | 70 | 229·66 | 5 | 344·49 | 40 | 459·33 | 75 | 574·16 | 10 | 688·99 |

TABLE XVI.—(*continued*).

CONVERSION OF MÈTRES INTO ENGLISH FEET.

**211 to 420.**

| Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 211 | 692·27 | 246 | 807·10 | 281 | 921·93 | 316 | 1036·76 | 351 | 1151·60 | 386 | 1266·43 |
| 12 | 695·55 | 47 | 810·38 | 82 | 925·21 | 17 | 1040·05 | 52 | 1154·88 | 87 | 1269·71 |
| 13 | 698·83 | 48 | 813·66 | 83 | 928·49 | 18 | 1043·33 | 53 | 1158·16 | 88 | 1272·99 |
| 14 | 702·11 | 49 | 816·94 | 84 | 931·78 | 19 | 1046·61 | 54 | 1161·44 | 89 | 1276·27 |
| 15 | 705·39 | 50 | 820·22 | 85 | 935·06 | 20 | 1049·89 | 55 | 1164·72 | 90 | 1279·55 |
| 216 | 708·67 | 251 | 823·51 | 286 | 938·34 | 321 | 1053·17 | 356 | 1168·00 | 391 | 1282·83 |
| 17 | 711·96 | 52 | 826·79 | 87 | 941·62 | 22 | 1056·45 | 57 | 1171·28 | 92 | 1286·11 |
| 18 | 715·24 | 53 | 830·07 | 88 | 944·90 | 23 | 1059·73 | 58 | 1174·56 | 93 | 1289·39 |
| 19 | 718·52 | 54 | 833·35 | 89 | 948·18 | 24 | 1063·01 | 59 | 1177·84 | 94 | 1292·67 |
| 20 | 721·80 | 55 | 836·63 | 90 | 951·46 | 25 | 1066·29 | 60 | 1181·12 | 95 | 1295·95 |
| 221 | 725·08 | 256 | 839·91 | 291 | 954·74 | 326 | 1069·57 | 361 | 1184·40 | 396 | 1299·23 |
| 22 | 728·36 | 57 | 843·19 | 92 | 958·02 | 27 | 1072·85 | 62 | 1187·69 | 97 | 1302·52 |
| 23 | 731·64 | 58 | 846·47 | 93 | 961·30 | 28 | 1076·13 | 63 | 1190·97 | 98 | 1305·80 |
| 24 | 734·92 | 59 | 849·75 | 94 | 964·58 | 29 | 1079·42 | 64 | 1194·25 | 99 | 1309·08 |
| 25 | 738·20 | 60 | 853·03 | 95 | 967·87 | 30 | 1082·70 | 65 | 1197·53 | 400 | 1312·36 |
| 226 | 741·48 | 261 | 856·31 | 296 | 971·15 | 331 | 1085·98 | 366 | 1200·81 | 401 | 1315·64 |
| 27 | 744·76 | 62 | 859·60 | 97 | 974·43 | 32 | 1089·26 | 67 | 1204·09 | 2 | 1318·92 |
| 28 | 748·05 | 63 | 862·88 | 98 | 977·71 | 33 | 1092·54 | 68 | 1207·37 | 3 | 1322·20 |
| 29 | 751·33 | 64 | 866·16 | 99 | 980·99 | 34 | 1095·82 | 69 | 1210·65 | 4 | 1325·48 |
| 30 | 754·61 | 65 | 869·44 | 300 | 984·27 | 35 | 1099·10 | 70 | 1213·93 | 5 | 1328·76 |
| 231 | 757·89 | 266 | 872·72 | 301 | 987·55 | 336 | 1102·38 | 371 | 1217·21 | 406 | 1332·05 |
| 32 | 761·17 | 67 | 876·00 | 2 | 990·83 | 37 | 1105·66 | 72 | 1220·49 | 7 | 1335·33 |
| 33 | 764·45 | 68 | 879·28 | 3 | 994·11 | 38 | 1108·94 | 73 | 1223·78 | 8 | 1338·61 |
| 34 | 767·73 | 69 | 882·56 | 4 | 997·39 | 39 | 1112·22 | 74 | 1227·06 | 9 | 1341·89 |
| 35 | 771·01 | 70 | 885·84 | 5 | 1000·67 | 40 | 1115·51 | 75 | 1230·34 | 10 | 1345·17 |
| 236 | 774·29 | 271 | 889·12 | 306 | 1003·96 | 341 | 1118·79 | 376 | 1233·62 | 411 | 1348·45 |
| 37 | 777·57 | 72 | 892·40 | 7 | 1007·24 | 42 | 1122·07 | 77 | 1236·90 | 12 | 1351·73 |
| 38 | 780·85 | 73 | 895·69 | 8 | 1010·52 | 43 | 1125·35 | 78 | 1240·18 | 13 | 1355·01 |
| 39 | 784·13 | 74 | 898·97 | 9 | 1013·80 | 44 | 1128·63 | 79 | 1243·46 | 14 | 1358·29 |
| 40 | 787·42 | 75 | 902·25 | 10 | 1017·08 | 45 | 1131·91 | 80 | 1246·74 | 15 | 1361·57 |
| 241 | 790·70 | 276 | 905·53 | 311 | 1020·36 | 346 | 1135·19 | 381 | 1250·02 | 416 | 1364·85 |
| 42 | 793·98 | 77 | 908·81 | 12 | 1023·64 | 47 | 1138·47 | 82 | 1253·30 | 17 | 1368·13 |
| 43 | 797·26 | 78 | 912·09 | 13 | 1026·92 | 48 | 1141·75 | 83 | 1256·58 | 18 | 1371·42 |
| 44 | 800·54 | 79 | 915·37 | 14 | 1030·20 | 49 | 1145·03 | 84 | 1259·87 | 19 | 1374·70 |
| 45 | 803·82 | 80 | 918·65 | 15 | 1033·48 | 50 | 1148·31 | 85 | 1263·15 | 20 | 1377·98 |

TABLE XVI.—(*continued*).

CONVERSION OF MÈTRES INTO ENGLISH FEET.

**421 to 630.**

| Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 421 | 1381·26 | 456 | 1496·09 | 491 | 1610·92 | 526 | 1725·75 | 561 | 1840·58 | 596 | 1955·42 |
| 22 | 1384·54 | 57 | 1499·37 | 92 | 1614·20 | 27 | 1729·03 | 62 | 1843·87 | 97 | 1958·70 |
| 23 | 1387·82 | 58 | 1502·65 | 93 | 1617·48 | 28 | 1732·31 | 63 | 1847·15 | 98 | 1961·98 |
| 24 | 1391·10 | 59 | 1505·93 | 94 | 1620·76 | 29 | 1735·60 | 64 | 1850·43 | 99 | 1965·26 |
| 25 | 1394·38 | 60 | 1509·21 | 95 | 1624·05 | 30 | 1738·88 | 65 | 1853·71 | 600 | 1968·54 |
| 426 | 1397·66 | 461 | 1512·49 | 496 | 1627·33 | 531 | 1742·16 | 566 | 1856·99 | 601 | 1971·82 |
| 27 | 1400·94 | 62 | 1515·78 | 97 | 1630·61 | 32 | 1745·44 | 67 | 1860·27 | 2 | 1975·10 |
| 28 | 1404·22 | 63 | 1519·06 | 98 | 1633·89 | 33 | 1748·72 | 68 | 1863·55 | 3 | 1978·38 |
| 29 | 1407·51 | 64 | 1522·34 | 99 | 1637·17 | 34 | 1752·00 | 69 | 1866·83 | 4 | 1981·66 |
| 30 | 1410·79 | 65 | 1525·62 | 500 | 1640·45 | 35 | 1755·28 | 70 | 1870·11 | 5 | 1984·94 |
| 431 | 1414·07 | 466 | 1528·90 | 501 | 1643·73 | 536 | 1758·56 | 571 | 1873·39 | 606 | 1988·22 |
| 32 | 1417·35 | 67 | 1532·18 | 2 | 1647·01 | 37 | 1761·84 | 72 | 1876·67 | 7 | 1991·51 |
| 33 | 1420·63 | 68 | 1535·46 | 3 | 1650·29 | 38 | 1765·12 | 73 | 1879·95 | 8 | 1994·79 |
| 34 | 1423·91 | 69 | 1538·74 | 4 | 1653·57 | 39 | 1768·40 | 74 | 1883·23 | 9 | 1998·07 |
| 35 | 1427·19 | 70 | 1542·02 | 5 | 1656·85 | 40 | 1771·69 | 75 | 1886·52 | 10 | 2001·35 |
| 436 | 1430·47 | 471 | 1545·30 | 506 | 1660·13 | 541 | 1774·97 | 576 | 1889·80 | 611 | 2004·63 |
| 37 | 1433·75 | 72 | 1548·58 | 7 | 1663·42 | 42 | 1778·25 | 77 | 1893·08 | 12 | 2007·91 |
| 38 | 1437·03 | 73 | 1551·87 | 8 | 1666·70 | 43 | 1781·53 | 78 | 1896·36 | 13 | 2011·19 |
| 39 | 1440·31 | 74 | 1555·15 | 9 | 1669·98 | 44 | 1784·81 | 79 | 1899·64 | 14 | 2014·47 |
| 40 | 1443·60 | 75 | 1558·43 | 10 | 1673 26 | 45 | 1788·09 | 80 | 1902·92 | 15 | 2017·75 |
| 441 | 1446·88 | 476 | 1561·71 | 511 | 1676·54 | 546 | 1791·37 | 581 | 1906·20 | 616 | 2021·03 |
| 42 | 1450·16 | 77 | 1564·99 | 12 | 1679·82 | 47 | 1794·65 | 82 | 1909·48 | 17 | 2024·31 |
| 43 | 1453·44 | 78 | 1568·27 | 13 | 1683·10 | 48 | 1797·93 | 83 | 1912·76 | 18 | 2027·60 |
| 44 | 1456·72 | 79 | 1571·55 | 14 | 1686·38 | 49 | 1801·21 | 84 | 1916·05 | 19 | 2030·88 |
| 45 | 1460·00 | 80 | 1574·83 | 15 | 1689·66 | 50 | 1804·49 | 85 | 1919·33 | 20 | 2034·16 |
| 446 | 1463·28 | 481 | 1578·11 | 516 | 1692·94 | 551 | 1807·78 | 586 | 1922·61 | 621 | 2037·44 |
| 47 | 1466·56 | 82 | 1581·39 | 17 | 1696·22 | 52 | 1811·06 | 87 | 1925·89 | 22 | 2040·72 |
| 48 | 1469·84 | 83 | 1584·67 | 18 | 1699·51 | 53 | 1814·34 | 88 | 1929·17 | 23 | 2044·00 |
| 49 | 1473·12 | 84 | 1587·96 | 19 | 1702·79 | 54 | 1817·62 | 89 | 1932·45 | 24 | 2047·28 |
| 50 | 1476·40 | 85 | 1591·23 | 20 | 1706·07 | 55 | 1820·90 | 90 | 1935·73 | 25 | 2050·56 |
| 451 | 1479·69 | 486 | 1594·52 | 521 | 1709·35 | 556 | 1824·18 | 591 | 1939·01 | 626 | 2053·84 |
| 52 | 1482·97 | 87 | 1597·80 | 22 | 1712·63 | 57 | 1827·46 | 92 | 1942·29 | 27 | 2057·12 |
| 53 | 1486·25 | 88 | 1601·08 | 23 | 1715·91 | 58 | 1830·74 | 93 | 1945·57 | 28 | 2060·40 |
| 54 | 1489·53 | 89 | 1604·36 | 24 | 1719·19 | 59 | 1834·02 | 94 | 1948·85 | 29 | 2063·69 |
| 55 | 1492·81 | 90 | 1607·64 | 25 | 1722·47 | 60 | 1837·30 | 95 | 1952·13 | 30 | 2066·97 |

## TABLE XVI.—(*continued*).

### Conversion of Mètres into English Feet.

### 631 to 840.

| Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 631 | 2070·25 | 666 | 2185·08 | 701 | 2299·91 | 736 | 2414·74 | 771 | 2529·57 | 806 | 2644·40 |
| 32 | 2073·53 | 67 | 2188·36 | 2 | 2303·19 | 37 | 2418·02 | 72 | 2532·85 | 7 | 2647·69 |
| 33 | 2076·81 | 68 | 2191·64 | 3 | 2306·47 | 38 | 2421·30 | 73 | 2536·13 | 8 | 2650·97 |
| 34 | 2080·09 | 69 | 2194·92 | 4 | 2309·75 | 39 | 2424·58 | 74 | 2539·42 | 9 | 2654·25 |
| 35 | 2083·37 | 70 | 2198·20 | 5 | 2313·03 | 40 | 2427·87 | 75 | 2542·70 | 10 | 2657·53 |
| 636 | 2086·65 | 671 | 2201·48 | 706 | 2316·31 | 741 | 2431·15 | 776 | 2545·98 | 811 | 2660·81 |
| 37 | 2089·93 | 72 | 2204·76 | 7 | 2319·60 | 42 | 2434·43 | 77 | 2549·26 | 12 | 2664·09 |
| 38 | 2093·21 | 73 | 2208·05 | 8 | 2322·88 | 43 | 2437·71 | 78 | 2552·54 | 13 | 2667·37 |
| 39 | 2096·49 | 74 | 2211·33 | 9 | 2326·16 | 44 | 2440·99 | 79 | 2555·82 | 14 | 2670·65 |
| 40 | 2099·78 | 75 | 2214·61 | 10 | 2329·44 | 45 | 2444·27 | 80 | 2559·10 | 15 | 2673·93 |
| 641 | 2103·06 | 676 | 2217·89 | 711 | 2332·72 | 746 | 2447·55 | 781 | 2562·38 | 816 | 2677·21 |
| 42 | 2106·34 | 77 | 2221·17 | 12 | 2336·00 | 47 | 2450·83 | 82 | 2565·66 | 17 | 2680·49 |
| 43 | 2109·62 | 78 | 2224·45 | 13 | 2339·28 | 48 | 2454·11 | 83 | 2568·94 | 18 | 2683·78 |
| 44 | 2112·90 | 79 | 2227·73 | 14 | 2342·56 | 49 | 2457·39 | 84 | 2572·22 | 19 | 2687·06 |
| 45 | 2116·18 | 80 | 2231·01 | 15 | 2345·84 | 50 | 2460·67 | 85 | 2575·51 | 20 | 2690·34 |
| 646 | 2119·46 | 681 | 2234·29 | 716 | 2349·12 | 751 | 2463·96 | 786 | 2578·79 | 821 | 2693·62 |
| 47 | 2122·74 | 82 | 2237·57 | 17 | 2352·40 | 52 | 2467·24 | 87 | 2582·07 | 22 | 2696·90 |
| 48 | 2126·02 | 83 | 2240·85 | 18 | 2355·69 | 53 | 2470·52 | 88 | 2585·35 | 23 | 2700·18 |
| 49 | 2129·30 | 84 | 2244·13 | 19 | 2358·97 | 54 | 2473·80 | 89 | 2588·63 | 24 | 2703·46 |
| 50 | 2132·58 | 85 | 2247·42 | 20 | 2362·25 | 55 | 2477·08 | 90 | 2591·91 | 25 | 2706·74 |
| 651 | 2135·87 | 686 | 2250·70 | 721 | 2365·53 | 756 | 2480·36 | 791 | 2595·19 | 826 | 2710·02 |
| 52 | 2139·15 | 87 | 2253·98 | 22 | 2368·81 | 57 | 2483·64 | 92 | 2598·47 | 27 | 2713·30 |
| 53 | 2142·43 | 88 | 2257·26 | 23 | 2372·09 | 58 | 2486·92 | 93 | 2601·75 | 28 | 2716·58 |
| 54 | 2145·71 | 89 | 2260·54 | 24 | 2375·37 | 59 | 2490·20 | 94 | 2605·03 | 29 | 2719·87 |
| 55 | 2148·99 | 90 | 2263·82 | 25 | 2378·65 | 60 | 2493·48 | 95 | 2608·31 | 30 | 2723·15 |
| 656 | 2152·27 | 691 | 2267·10 | 726 | 2381·93 | 761 | 2496·76 | 796 | 2611·60 | 831 | 2726·43 |
| 57 | 2155·55 | 92 | 2270·38 | 27 | 2385·21 | 62 | 2500·05 | 97 | 2614·88 | 32 | 2729·71 |
| 58 | 2158·83 | 93 | 2273·66 | 28 | 2388·49 | 63 | 2503·33 | 98 | 2618·16 | 33 | 2732·99 |
| 59 | 2162·11 | 94 | 2276·94 | 29 | 2391·78 | 64 | 2506·61 | 99 | 2621·44 | 34 | 2736·27 |
| 60 | 2165·39 | 95 | 2280·22 | 30 | 2395·06 | 65 | 2509·89 | 800 | 2624·72 | 35 | 2739·55 |
| 661 | 2168·67 | 696 | 2283·51 | 731 | 2398·34 | 766 | 2513·17 | 801 | 2628·00 | 836 | 2742·83 |
| 62 | 2171·96 | 97 | 2286·79 | 32 | 2401·62 | 67 | 2516·45 | 2 | 2631·28 | 37 | 2746·11 |
| 63 | 2175·24 | 98 | 2290·07 | 33 | 2404·90 | 68 | 2519·73 | 3 | 2634·56 | 38 | 2749·39 |
| 64 | 2178·52 | 99 | 2293·35 | 34 | 2408·18 | 69 | 2523·01 | 4 | 2637·84 | 39 | 2752·67 |
| 65 | 2181·80 | 700 | 2296·63 | 35 | 2411·46 | 70 | 2526·29 | 5 | 2641·12 | 40 | 2755·96 |

## TABLE XVI.—(*continued*).

### Conversion of Mètres into English Feet.

### 841 to 1000.

| Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. | Mètres | Feet. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 841 | 2759·24 | 871 | 2857·66 | 901 | 2956·09 | 926 | 3038·11 | 951 | 3120·14 | 976 | 3202·16 |
| 42 | 2762·52 | 72 | 2860·94 | 2 | 2959·37 | 27 | 3041·39 | 52 | 3123·42 | 77 | 3205·44 |
| 43 | 2765·80 | 73 | 2864·22 | 3 | 2962·65 | 28 | 3044·67 | 53 | 3126·70 | 78 | 3208·72 |
| 44 | 2769·08 | 74 | 2867·51 | 4 | 2965·93 | 29 | 3047·96 | 54 | 3129·98 | 79 | 3212·00 |
| 45 | 2772·36 | 75 | 2870·79 | 5 | 2969·21 | 30 | 3051·24 | 55 | 3133·26 | 80 | 3215·28 |
| 846 | 2775·64 | 876 | 2874·07 | 906 | 2972·49 | 931 | 3054·52 | 956 | 3136·54 | 981 | 3218·56 |
| 47 | 2778·92 | 77 | 2877·35 | 7 | 2975·78 | 32 | 3057·80 | 57 | 3139·82 | 82 | 3221·84 |
| 48 | 2782·20 | 78 | 2880·63 | 8 | 2979·06 | 33 | 3061·08 | 58 | 3143·10 | 83 | 3225·12 |
| 49 | 2785·48 | 79 | 2883·91 | 9 | 2982·34 | 34 | 3064·36 | 59 | 3146·38 | 84 | 3228·40 |
| 50 | 2788·76 | 80 | 2887·19 | 10 | 2985·62 | 35 | 3067·64 | 60 | 3149·66 | 85 | 3231·69 |
| 851 | 2792·05 | 881 | 2890·47 | 911 | 2988·90 | 936 | 3070·92 | 961 | 3152·94 | 986 | 3234·97 |
| 52 | 2795·33 | 82 | 2893·75 | 12 | 2992·18 | 37 | 3074·20 | 62 | 3156·22 | 87 | 3238·25 |
| 53 | 2798·61 | 83 | 2897·03 | 13 | 2995·46 | 38 | 3077·48 | 63 | 3159·51 | 88 | 3241·53 |
| 54 | 2801·89 | 84 | 2900·31 | 14 | 2998·74 | 39 | 3080·76 | 64 | 3162·79 | 89 | 3244·81 |
| 55 | 2805·17 | 85 | 2903·60 | 15 | 3002·02 | 40 | 3084·05 | 65 | 3166·07 | 90 | 3248·09 |
| 856 | 2808·45 | 886 | 2906·88 | 916 | 3005·30 | 941 | 3087·33 | 966 | 3169·35 | 991 | 3251·37 |
| 57 | 2811·73 | 87 | 2910·16 | 17 | 3008·58 | 42 | 3090·61 | 67 | 3172·63 | 92 | 3254·65 |
| 58 | 2815·01 | 88 | 2913·44 | 18 | 3011·87 | 43 | 3093·89 | 68 | 3175·91 | 93 | 3257·93 |
| 59 | 2818·29 | 89 | 2916·72 | 19 | 3015·15 | 44 | 3097·17 | 69 | 3179·19 | 94 | 3261·21 |
| 60 | 2821·57 | 90 | 2920·00 | 20 | 3018·43 | 45 | 3100·45 | 70 | 3182·47 | 95 | 3264·49 |
| 861 | 2824·85 | 891 | 2923·28 | 921 | 3021·71 | 946 | 3103·73 | 971 | 3185·75 | 996 | 3267·78 |
| 62 | 2828·14 | 92 | 2926·56 | 22 | 3024·99 | 47 | 3107·01 | 72 | 3189·03 | 97 | 3271·06 |
| 63 | 2831·42 | 93 | 2929·84 | 23 | 3028·27 | 48 | 3110·29 | 73 | 3192·31 | 98 | 3274·34 |
| 64 | 2834·70 | 94 | 2933·12 | 24 | 3031·55 | 49 | 3113·57 | 74 | 3195·60 | 99 | 3277·62 |
| 65 | 2837·98 | 95 | 2936·40 | 25 | 3034·83 | 50 | 3116·85 | 75 | 3198·88 | 1000 | 3280·90 |
| 866 | 2841·26 | 896 | 2939·69 | | | | | | | | |
| 67 | 2844·54 | 97 | 2942·97 | | | | | | | | |
| 68 | 2847·82 | 98 | 2946·25 | | | | | | | | |
| 69 | 2851·10 | 99 | 2949·53 | | | | | | | | |
| 70 | 2854·38 | 900 | 2952·81 | | | | | | | | |

## TABLE XVII.

### Conversion of Kilomètres into English Statute Miles.

| Kilomètres. | English Statute Miles. | Kilomètres. | English Statute Miles. | Kilomètres. | English Statute Miles. | Kilomètres. | English Statute Miles. | Kilomètres. | English Statute Miles. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0·62 | 21 | 13·05 | 41 | 25·48 | 61 | 37·90 | 81 | 50·33 |
| 2 | 1·24 | 22 | 13·67 | 42 | 26·10 | 62 | 38·53 | 82 | 50·95 |
| 3 | 1·86 | 23 | 14·29 | 43 | 26·72 | 63 | 39·15 | 83 | 51·57 |
| 4 | 2·49 | 24 | 14·91 | 44 | 27·34 | 64 | 39·77 | 84 | 52·20 |
| 5 | 3·11 | 25 | 15·53 | 45 | 27·96 | 65 | 40·39 | 85 | 52·82 |
| 6 | 3·73 | 26 | 16·16 | 46 | 28·58 | 66 | 41·01 | 86 | 53·44 |
| 7 | 4·35 | 27 | 16·78 | 47 | 29·21 | 67 | 41·63 | 87 | 54·06 |
| 8 | 4·97 | 28 | 17·50 | 48 | 29·83 | 68 | 42·25 | 88 | 54·68 |
| 9 | 5·59 | 29 | 18·02 | 49 | 30·45 | 69 | 42·88 | 89 | 55·30 |
| 10 | 6·21 | 30 | 18·64 | 50 | 31·07 | 70 | 43·50 | 90 | 55·92 |
| 11 | 6·84 | 31 | 19·26 | 51 | 31·69 | 71 | 44·12 | 91 | 56·55 |
| 12 | 7·46 | 32 | 19·88 | 52 | 32·31 | 72 | 44·74 | 92 | 57·17 |
| 13 | 8·08 | 33 | 20·51 | 53 | 32·93 | 73 | 45·36 | 93 | 57·79 |
| 14 | 8·70 | 34 | 21·13 | 54 | 33·55 | 74 | 45·98 | 94 | 58·41 |
| 15 | 9·32 | 35 | 21·75 | 55 | 34·18 | 75 | 46·60 | 95 | 59·03 |
| 16 | 9·94 | 36 | 22·37 | 56 | 34·90 | 76 | 47·23 | 96 | 59·65 |
| 17 | 10·56 | 37 | 22·99 | 57 | 35·42 | 77 | 47·85 | 97 | 60·27 |
| 18 | 11·18 | 38 | 23·61 | 58 | 36·04 | 78 | 48·47 | 98 | 60·90 |
| 19 | 11·81 | 39 | 24·23 | 59 | 36·66 | 79 | 49·09 | 99 | 61·52 |
| 20 | 12·43 | 40 | 24·86 | 60 | 37·28 | 80 | 49·71 | 100 | 62·14 |
| 100 | 62·14 | 300 | 186·42 | 500 | 310·69 | 700 | 434·97 | 900 | 559·24 |
| 200 | 124·28 | 400 | 248·55 | 600 | 372·83 | 800 | 497·11 | 1000 | 621·38 |
| 1000 | 621·38 | 3000 | 1864·15 | 5000 | 3106·91 | 7000 | 4349·68 | 9000 | 5592·44 |
| 2000 | 1242·77 | 4000 | 2485·53 | 6000 | 3728·30 | 8000 | 4971·06 | 10,000 | 6213·82 |

## TABLE XVIII.

### Conversion of Russian Versts into English Statute Miles.

| Versts. | English Statute Miles. | Versts. | English Statute Miles. | Versts. | English Statute Miles. | Versts. | English Statute Miles. | Versts. | English Statute Miles. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0·66 | 21 | 13·92 | 41 | 27·18 | 61 | 40·44 | 81 | 53·69 |
| 2 | 1·33 | 22 | 14·58 | 42 | 27·84 | 62 | 41·10 | 82 | 54·36 |
| 3 | 1·99 | 23 | 15·25 | 43 | 28·50 | 63 | 41·76 | 83 | 55·02 |
| 4 | 2·65 | 24 | 15·91 | 44 | 29·17 | 64 | 42·42 | 84 | 55·68 |
| 5 | 3·31 | 25 | 16·57 | 45 | 29·83 | 65 | 43·09 | 85 | 56·34 |
| 6 | 3·98 | 26 | 17·23 | 46 | 30·49 | 66 | 43·75 | 86 | 57·01 |
| 7 | 4·64 | 27 | 17·90 | 47 | 31·16 | 67 | 44·41 | 87 | 57·67 |
| 8 | 5·30 | 28 | 18·56 | 48 | 31·82 | 68 | 45·08 | 88 | 58·33 |
| 9 | 5·97 | 29 | 19·22 | 49 | 32·48 | 69 | 45·74 | 89 | 59·00 |
| 10 | 6·63 | 30 | 19·89 | 50 | 33·14 | 70 | 46·40 | 90 | 59·66 |
| 11 | 7·29 | 31 | 20·55 | 51 | 33·81 | 71 | 47·06 | 91 | 60·32 |
| 12 | 7·95 | 32 | 21·21 | 52 | 34·47 | 72 | 47·73 | 92 | 60·98 |
| 13 | 8·62 | 33 | 21·88 | 53 | 35·13 | 73 | 48·39 | 93 | 61·65 |
| 14 | 9·28 | 34 | 22·54 | 54 | 35·80 | 74 | 49·05 | 94 | 62·31 |
| 15 | 9·94 | 35 | 23·20 | 55 | 36·46 | 75 | 49·72 | 95 | 62·97 |
| 16 | 10·61 | 36 | 23·86 | 56 | 37·12 | 76 | 50·38 | 96 | 63·64 |
| 17 | 11·27 | 37 | 24·53 | 57 | 37·78 | 77 | 51·04 | 97 | 64·30 |
| 18 | 11·93 | 38 | 25·19 | 58 | 38·45 | 78 | 51·70 | 98 | 64·96 |
| 19 | 12·59 | 39 | 25·85 | 59 | 39·11 | 79 | 52·37 | 99 | 65·63 |
| 20 | 13·26 | 40 | 26·52 | 60 | 39·77 | 80 | 53·03 | 100 | 66·29 |
| 100 | 66·29 | 300 | 198·86 | 500 | 231·44 | 700 | 464·02 | 900 | 596·59 |
| 200 | 132·58 | 400 | 265·15 | 600 | 397·73 | 800 | 530·30 | 1000 | 666·88 |
| 1000 | 662·88 | 3000 | 1988·64 | 5000 | 3314·39 | 7000 | 4640·15 | 9000 | 5965·91 |
| 2000 | 1325·76 | 4000 | 2651·52 | 6000 | 3977·27 | 8000 | 5303·03 | 10,000 | 6628·79 |

## TABLE XIX.

### For converting Kilogrammes into Pounds Avoirdupois.

| Kilogs. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | ·000 | 2·205 | 4·409 | 6·614 | 8·818 | 11·023 | 13·228 | 15·632 | 17·637 | 19·842 |
| 10 | 22·046 | 24·251 | 26·455 | 28·660 | 30·865 | 33·069 | 35·274 | 37·478 | 39·683 | 41·888 |
| 20 | 44·092 | 46·297 | 48·502 | 50·706 | 52·911 | 55·116 | 57·320 | 59·525 | 61·729 | 63·934 |
| 30 | 66·139 | 68·343 | 70·548 | 72·753 | 74·957 | 77·162 | 79·366 | 81·571 | 83·776 | 85·980 |
| 40 | 88·185 | 90·389 | 92·594 | 94·799 | 97·003 | 99·208 | 101·413 | 103·617 | 105·822 | 108·026 |
| 50 | 110·231 | 112·436 | 114·640 | 116·845 | 119·050 | 121·254 | 123·549 | 125·663 | 127·868 | 130·073 |
| 60 | 132·277 | 134·482 | 136·686 | 138·891 | 141·096 | 143·300 | 145·505 | 147·710 | 149·914 | 152·119 |
| 70 | 154·323 | 156·528 | 158·733 | 160·937 | 163·142 | 165·347 | 167·551 | 169·356 | 171·960 | 174·165 |
| 80 | 176·370 | 178·574 | 180·779 | 182·984 | 185·188 | 187·393 | 189·597 | 191·802 | 194·007 | 196·211 |
| 90 | 198·416 | 200·620 | 202·825 | 205·030 | 207·234 | 209·439 | 211·644 | 213·848 | 216·053 | 218·258 |

## TABLE XX.—Foreign Moneys.

### With Equivalents in British Currency.

| *Country.* | *Principal Coins.* | Sterling. *s.* | *d.* |
|---|---|---|---|
| Austria | 100 new kreuzers = 1 florin | 1 | 8 |
| Belgium | 100 centimes = 1 franc | 0 | 9½ |
| Canada, etc. | 100 cents = 1 dollar | 4 | 0 |
| China | 1600—1700 copper cash = 1 Haikwan tael | 4 | 10½ |
| Denmark | 100 öre = 1 Krone | 1 | 1⅓ |
| France | 100 centimes = 1 franc | 0 | 9½ |
| | Milliard = f. 1000 mills. = £40,000 000. | | |
| Germany | North German or Prussian thaler | 3 | 0 |
| | South German florin | 1 | 8 |
| | Imperial Reichsmark = 100 Pfennige | 1 | 0 |
| | Imperial gold piece of 20 marks | 20 | 0 |
| Greece | 100 centimes = 1 franc | 0 | 9½ |
| Holland | 100 cents or 20 stivers = 1 florin | 1 | 8 |
| India | 192 pie = 64 pice = 16 annas = 1 rupee | about 1 | 3 |
| | The lac is 100,000 rupees. | | |
| Italy | 100 centesimi = 1 lira | 0 | 9½ |
| Norway | 100 öre = 1 Krone | 1 | 1⅛ |
| Portugal | 1000 Reis = 1 milrei | 4 | 5 |
| Russia | 100 copecs = 1 silver rouble | 3 | 2 |
| Spain | 100 centisimos = 1 peseta = 4 reales | 0 | 9½ |
| Sweden | 100 öre = 1 Krone | 1 | 1⅛ |
| Switzerland | 100 rappen or centimes = 1 franc | 0 | 9½ |
| Turkey | 100 piastre = 1 lira, *variable* | 1½*d.* to 0 | 2⅓ |
| United States | 100 cents = 1 dollar ($) *in gold* | 4 | 1 |
| | 10 dollars = 1 eagle | 41 | 1 |

# TABLE XXI.

TRAVERSE TABLE: *Difference of Latitude and Departure.*

| D. | 1 Deg. | | 2 Deg. | | 3 Deg. | | 4 Deg. | | 5 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 01·0 | 00·0 | 01·0 | 00·0 | 01·0 | 00·1 | 01·0 | 00·1 | 01·0 | 00·1 |
| 2 | 02·0 | 00·0 | 02·0 | 00·1 | 02·0 | 00·1 | 02·0 | 00·1 | 02·0 | 00·2 |
| 3 | 03·0 | 00·1 | 03·0 | 00·1 | 03·0 | 00·2 | 03·0 | 00·2 | 03·0 | 00·3 |
| 4 | 04·0 | 00·1 | 04·0 | 00·1 | 04·0 | 00·2 | 04·0 | 00·3 | 04·0 | 00·3 |
| 5 | 05·0 | 00·1 | 05·0 | 00·2 | 05·0 | 00·3 | 05·0 | 00·3 | 05·0 | 00·4 |
| 6 | 06·0 | 00·1 | 06·0 | 00·2 | 06·0 | 00·3 | 06·0 | 00·4 | 06·0 | 00·5 |
| 7 | 07·0 | 00·1 | 07·0 | 00·2 | 07·0 | 00·4 | 07·0 | 00·5 | 07·0 | 00·6 |
| 8 | 08·0 | 00·1 | 08·0 | 00·3 | 08·0 | 00·4 | 08·0 | 00·6 | 08·0 | 00·7 |
| 9 | 09·0 | 00·2 | 09·0 | 00·3 | 09·0 | 00·5 | 09·0 | 00·6 | 09·0 | 00·8 |
| 10 | 10·0 | 00·2 | 10·0 | 00·3 | 10·0 | 00·5 | 10·0 | 00·7 | 10·0 | 00·9 |
| 20 | 20·0 | 00·3 | 20·0 | 00·7 | 20·0 | 01·0 | 20·0 | 01·4 | 19·9 | 01·7 |
| 30 | 30·0 | 00·5 | 30·0 | 01·0 | 30·0 | 01·6 | 29·9 | 02·1 | 29·9 | 02·6 |
| 40 | 40·0 | 00·7 | 40·0 | 01·4 | 39·9 | 02·1 | 39·9 | 02·8 | 39·8 | 03·5 |
| 50 | 50·0 | 00·9 | 50·0 | 01·7 | 49·9 | 02·6 | 49·9 | 03·5 | 49·8 | 04·4 |
| 60 | 60·0 | 01·0 | 60·0 | 02·1 | 59·9 | 03·1 | 59·9 | 04·2 | 59·8 | 05·2 |
| 70 | 70·0 | 01·2 | 70·0 | 02·4 | 69·9 | 03·7 | 69·8 | 04·9 | 69·7 | 06·1 |
| 80 | 80·0 | 01·4 | 80·0 | 02·8 | 79·9 | 04·2 | 79·8 | 05·6 | 79·7 | 07·0 |
| 90 | 90·0 | 01·6 | 90·0 | 03·1 | 89·9 | 04·7 | 89·8 | 06·3 | 89·7 | 07·8 |
| 100 | 100·0 | 01·7 | 99·9 | 03·5 | 99·9 | 05·2 | 99·8 | 07·0 | 99·6 | 08·7 |
| 200 | 200·0 | 03·5 | 199·9 | 07·0 | 199·7 | 10·5 | 199·5 | 14·0 | 199·2 | 17·4 |
| 300 | 300·0 | 05·2 | 299·8 | 10·5 | 299·6 | 15·7 | 299·3 | 20·9 | 298·9 | 26·1 |
| 400 | 399·9 | 07·0 | 399·8 | 14·0 | 399·5 | 20·9 | 399·0 | 27·9 | 398·5 | 34·9 |
| 500 | 499·9 | 08·7 | 499·7 | 17·5 | 499·3 | 26·2 | 498·8 | 34·9 | 498·1 | 43·6 |
| 600 | 599·9 | 10·5 | 599·6 | 20·9 | 599·2 | 31·4 | 598·5 | 41·9 | 597·7 | 52·3 |
| 700 | 699·9 | 12·2 | 699·6 | 24·4 | 699·0 | 36·6 | 698·3 | 48·8 | 697·3 | 61·0 |
| 800 | 799·9 | 14·0 | 799·5 | 27·9 | 798·9 | 41·9 | 798·1 | 55·8 | 797·0 | 69·7 |
| 900 | 899·9 | 15·7 | 899·5 | 31·4 | 898·8 | 47·1 | 897·8 | 62·8 | 896·6 | 78·4 |
| | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| D. | 89 Deg. | | 88 Deg. | | 87 Deg. | | 86 Deg. | | 85 Deg. | |

## TABLE XXI.—(*continued*).

TRAVERSE TABLE: *Difference of Latitude and Departure.*

| D. | 6 Deg. | | 7 Deg. | | 8 Deg. | | 9 Deg. | | 10 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 01·0 | 00·1 | 01·0 | 00·1 | 01·0 | 00·1 | 01·0 | 00·2 | 01·0 | 00·2 |
| 2 | 02·0 | 00·2 | 02·0 | 00·2 | 02·0 | 00·3 | 02·0 | 00·3 | 02·0 | 00·3 |
| 3 | 03·0 | 00·3 | 03·0 | 00·4 | 03·0 | 00·4 | 03·0 | 00·5 | 03·0 | 00·5 |
| 4 | 04·0 | 00·4 | 04·0 | 00·5 | 04·0 | 00·6 | 04·0 | 00·6 | 03·9 | 00·7 |
| 5 | 05·0 | 00·5 | 05·0 | 00·6 | 05·0 | 00·7 | 04·9 | 00·8 | 04·9 | 00·9 |
| 6 | 06·0 | 00·6 | 06·0 | 00·7 | 05·9 | 00·8 | 05·9 | 00·9 | 05·9 | 01·0 |
| 7 | 07·0 | 00·7 | 06·9 | 00·9 | 06·9 | 01·0 | 06·9 | 01·1 | 06·9 | 01·2 |
| 8 | 08·0 | 00·8 | 07·9 | 01·0 | 07·9 | 01·1 | 07·9 | 01·3 | 07·9 | 01·4 |
| 9 | 09·0 | 00·9 | 08·9 | 01·1 | 08·9 | 01·3 | 08·9 | 01·4 | 08·9 | 01·6 |
| 10 | 09·9 | 01·0 | 09·9 | 01·2 | 09·9 | 01·4 | 09·9 | 01·6 | 09·8 | 01·7 |
| 20 | 19·9 | 02·1 | 19·9 | 02·4 | 19·8 | 02·8 | 19·8 | 03·1 | 19·7 | 03·5 |
| 30 | 29·8 | 03·1 | 29·8 | 03·7 | 29·7 | 04·2 | 29·6 | 04·7 | 29·5 | 05·2 |
| 40 | 39·8 | 04·2 | 39·7 | 04·9 | 39·6 | 05·6 | 39·5 | 06·3 | 39·4 | 06·9 |
| 50 | 49·7 | 05·2 | 49·6 | 06·1 | 49·5 | 07·0 | 49·4 | 07·8 | 49·2 | 08·7 |
| 60 | 59·7 | 06·3 | 59·6 | 07·3 | 59·4 | 08·4 | 59·3 | 09·4 | 59·1 | 10·4 |
| 70 | 69·6 | 07·3 | 69·5 | 08·5 | 69·3 | 09·7 | 69·1 | 11·0 | 68·9 | 12·2 |
| 80 | 79·6 | 08·4 | 79·4 | 09·7 | 79·2 | 11·1 | 79·0 | 12·5 | 78·8 | 13·9 |
| 90 | 89·5 | 09·4 | 89·3 | 11·0 | 89·1 | 12·5 | 88·9 | 14·1 | 88·6 | 15·6 |
| 100 | 99·5 | 10·5 | 99·3 | 12·2 | 99·0 | 13·9 | 98·8 | 15·6 | 98·5 | 17·4 |
| 200 | 198·9 | 20·9 | 198·5 | 24·4 | 198·1 | 27·8 | 197·5 | 31·3 | 197·0 | 34·7 |
| 300 | 298·4 | 31·4 | 297·8 | 36·6 | 297·1 | 41·8 | 296·3 | 46·9 | 295·4 | 52·1 |
| 400 | 397·8 | 41·8 | 397·0 | 48·7 | 396·1 | 55·7 | 395·1 | 62·6 | 393·9 | 69·5 |
| 500 | 497·3 | 52·3 | 496·3 | 60·9 | 495·1 | 69·6 | 493·8 | 78·2 | 492·4 | 86·8 |
| 600 | 596·7 | 62·7 | 595·5 | 73·1 | 594·2 | 83·5 | 592·6 | 93·9 | 590·9 | 104·2 |
| 700 | 696·2 | 73·2 | 694·8 | 85·3 | 693·2 | 97·4 | 691·4 | 109·5 | 689·4 | 121·6 |
| 800 | 795·6 | 83·6 | 794·0 | 97·5 | 792·2 | 111·3 | 790·2 | 125·1 | 787·8 | 138·9 |
| 900 | 895·1 | 94·1 | 893·3 | 109·7 | 891·2 | 125·3 | 888·9 | 140·8 | 886·3 | 156·3 |
| D. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| | 84 Deg. | | 83 Deg. | | 82 Deg. | | 81 Deg. | | 80 Deg. | |

## TABLE XXI.—(*continued*).

Traverse Table: *Difference of Latitude and Departure.*

| D. | 11 Deg. | | 12 Deg. | | 13 Deg. | | 14 Deg. | | 15 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 01·0 | 00·2 | 01·0 | 00·2 | 01·0 | 00·2 | 01·0 | 00·2 | 01·0 | 00·3 |
| 2 | 02·0 | 00·4 | 02·0 | 00·4 | 01·9 | 00·4 | 01·9 | 00·5 | 01·9 | 00·5 |
| 3 | 02·9 | 00·6 | 02·9 | 00·6 | 02·9 | 00·7 | 02·9 | 00·7 | 02·9 | 00·8 |
| 4 | 03·9 | 00·8 | 03·9 | 00·8 | 03·9 | 00·9 | 03·9 | 01·0 | 03·9 | 01·0 |
| 5 | 04·9 | 01·0 | 04·9 | 01·0 | 04·9 | 01·1 | 04·9 | 01·2 | 04·8 | 01·3 |
| 6 | 05·9 | 01·1 | 05·9 | 01·2 | 05·8 | 01·3 | 05·8 | 01·5 | 05·8 | 01·6 |
| 7 | 06·9 | 01·3 | 06·8 | 01·5 | 06·8 | 01·6 | 06·8 | 01·7 | 06·8 | 01·8 |
| 8 | 07·9 | 01·5 | 07·8 | 01·7 | 07·8 | 01·8 | 07·8 | 01·9 | 07·7 | 02·1 |
| 9 | 08·8 | 01·7 | 08·8 | 01·9 | 08·8 | 02·0 | 08·7 | 02·2 | 08·7 | 02·3 |
| 10 | 09·8 | 01·9 | 09·8 | 02·1 | 09·7 | 02·2 | 09·7 | 02·4 | 09·7 | 02·6 |
| 20 | 19·6 | 03·8 | 19·6 | 04·2 | 19·5 | 04·5 | 19·4 | 04·8 | 19·3 | 05·2 |
| 30 | 29·4 | 05·7 | 29·3 | 06·2 | 29·2 | 06·7 | 29·1 | 07·3 | 29·0 | 07·8 |
| 40 | 39·3 | 07·6 | 39·1 | 08·3 | 39·0 | 09·0 | 38·8 | 09·7 | 38·6 | 10·4 |
| 50 | 49·1 | 09·5 | 48·9 | 10·4 | 48·7 | 11·2 | 48·5 | 12·1 | 48·3 | 12·9 |
| 60 | 58·9 | 11·4 | 58·7 | 12·5 | 58·5 | 13·5 | 58·2 | 14·5 | 58·0 | 15·5 |
| 70 | 68·7 | 13·4 | 68·5 | 14·6 | 68·2 | 15·7 | 67·9 | 16·9 | 67·6 | 18·1 |
| 80 | 78·5 | 15·3 | 78·3 | 16·6 | 77·9 | 18·0 | 77·6 | 19·4 | 77·3 | 20·7 |
| 90 | 88·3 | 17·2 | 88·0 | 18·7 | 87·7 | 20·2 | 87·3 | 21·8 | 86·9 | 23·3 |
| 100 | 98·2 | 19·1 | 97·8 | 20·8 | 97·4 | 22·5 | 97·0 | 24·2 | 96·6 | 25·9 |
| 200 | 196·3 | 38·2 | 195·6 | 41·6 | 194·9 | 45·0 | 194·1 | 48·4 | 193·2 | 51·8 |
| 300 | 294·5 | 57·2 | 293·4 | 62·4 | 292·3 | 67·5 | 291·1 | 72·6 | 289·8 | 77·6 |
| 400 | 392·7 | 76·3 | 391·3 | 83·2 | 389·7 | 90·0 | 388·1 | 96·8 | 386·4 | 103·5 |
| 500 | 490·8 | 95·4 | 489·1 | 104·0 | 487·2 | 112·5 | 485·1 | 121·0 | 483·0 | 129·4 |
| 600 | 589·0 | 114·5 | 586·9 | 124·7 | 584·6 | 135·0 | 582·2 | 145·2 | 579·6 | 155·3 |
| 700 | 687·1 | 133·6 | 684·7 | 145·5 | 682·1 | 157·5 | 679·2 | 169·3 | 676·1 | 181·2 |
| 800 | 785·3 | 152·6 | 782·5 | 166·3 | 779·5 | 180·0 | 776·2 | 193·5 | 772·7 | 207·1 |
| 900 | 883·3 | 171·7 | 880·3 | 187·1 | 876·9 | 202·5 | 873·3 | 217·7 | 869·3 | 232·9 |
| D. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| | 79 Deg. | | 78 Deg. | | 77 Deg. | | 76 Deg. | | 75 Deg. | |

TABLE XXI.—(*continued*).

TRAVERSE TABLE: *Difference of Latitude and Departure.*

| D. | 16 Deg. | | 17 Deg. | | 18 Deg. | | 19 Deg. | | 20 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 01·0 | 00·3 | 01·0 | 00·3 | 01·0 | 00·3 | 00·9 | 00·3 | 00·9 | 00·3 |
| 2 | 01·9 | 00·6 | 01·9 | 00·6 | 01·9 | 00·6 | 01·9 | 00·7 | 01·9 | 00·7 |
| 3 | 02·9 | 00·8 | 02·9 | 00·9 | 02·9 | 00·9 | 02·8 | 01·0 | 02·8 | 01·0 |
| 4 | 03·8 | 01·1 | 03·8 | 01·2 | 03·8 | 01·2 | 03·8 | 01·3 | 03·8 | 01·4 |
| 5 | 04·8 | 01·4 | 04·8 | 01·5 | 04·8 | 01·5 | 04·7 | 01·6 | 04·7 | 01·7 |
| 6 | 05·8 | 01·7 | 05·7 | 01·8 | 05·7 | 01·9 | 05·7 | 02·0 | 05·6 | 02·1 |
| 7 | 06·7 | 01·9 | 06·7 | 02·0 | 06·7 | 02·2 | 06·6 | 02·3 | 06·6 | 02·4 |
| 8 | 07·7 | 02·2 | 07·7 | 02·3 | 07·6 | 02·5 | 07·6 | 02·6 | 07·5 | 02·7 |
| 9 | 08·7 | 02·5 | 08·6 | 02·6 | 08·6 | 02·8 | 08·5 | 02·9 | 08·5 | 03·1 |
| 10 | 09·6 | 02·8 | 09·6 | 02·9 | 09·5 | 03·1 | 09·5 | 03·3 | 09·4 | 03·4 |
| 20 | 19·2 | 05·5 | 19·1 | 05·8 | 19·0 | 06·2 | 18·9 | 06·5 | 18·8 | 06·8 |
| 30 | 28·8 | 08·3 | 28·7 | 08·8 | 28·5 | 09·3 | 28·4 | 09·8 | 28·2 | 10·3 |
| 40 | 38·5 | 11·0 | 38·3 | 11·7 | 38·0 | 12·4 | 37·8 | 13·0 | 37·6 | 13·7 |
| 50 | 48·1 | 13·8 | 47·8 | 14·6 | 47·6 | 15·5 | 47·3 | 16·3 | 47·0 | 17·1 |
| 60 | 57·7 | 16·5 | 57·4 | 17·5 | 57·1 | 18·5 | 56·7 | 19·5 | 56·4 | 20·5 |
| 70 | 67·3 | 19·3 | 66·9 | 20·5 | 66·6 | 21·6 | 66·2 | 22·8 | 65·8 | 23·9 |
| 80 | 76·9 | 22·1 | 76·5 | 23·4 | 76·1 | 24·7 | 75·6 | 26·0 | 75·2 | 27·4 |
| 90 | 86·5 | 24·8 | 86·1 | 26·3 | 85·6 | 27·8 | 85·1 | 29·3 | 84·6 | 30·8 |
| 100 | 96·1 | 27·6 | 95·6 | 29·2 | 95·1 | 30·9 | 94·6 | 32·6 | 94·0 | 34·2 |
| 200 | 192·3 | 55·1 | 191·3 | 58·5 | 190·2 | 61·8 | 189·1 | 65·1 | 187·9 | 68·4 |
| 300 | 288·4 | 82·7 | 286·9 | 87·7 | 285·3 | 92·7 | 283·7 | 97·7 | 281·9 | 102·6 |
| 400 | 384·5 | 110·3 | 382·5 | 116·9 | 380·4 | 123·6 | 378·2 | 130·2 | 375·9 | 136·8 |
| 500 | 480·6 | 137·8 | 478·2 | 146·2 | 475·5 | 154·5 | 472·8 | 162·8 | 469·8 | 171·0 |
| 600 | 576·8 | 165·4 | 573·8 | 175·4 | 570·6 | 185·4 | 567·3 | 195·3 | 563·8 | 205·2 |
| 700 | 672·9 | 192·9 | 669·4 | 204·7 | 665·7 | 216·3 | 661·9 | 227·9 | 657·8 | 239·4 |
| 800 | 769·0 | 220·5 | 765·0 | 233·9 | 760·8 | 247·2 | 756·4 | 260·5 | 751·8 | 273·6 |
| 900 | 865·1 | 248·1 | 860·7 | 263·1 | 856·0 | 278·1 | 851·0 | 293·0 | 845·7 | 307·8 |
| D. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| | 74 Deg. | | 73 Deg. | | 72 Deg. | | 71 Deg. | | 70 Deg. | |

## TABLE XXI.—(*continued*).

TRAVERSE TABLE: *Difference of Latitude and Departure.*

| D. | 21 Deg. | | 22 Deg. | | 23 Deg. | | 24 Deg. | | 25 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 00·9 | 00·4 | 00·9 | 00·4 | 00·9 | 00·4 | 00·9 | 00·4 | 00·9 | 00·4 |
| 2 | 01·9 | 00·7 | 01·9 | 00·7 | 01·8 | 00·8 | 01·8 | 00·8 | 01·8 | 00·8 |
| 3 | 02·8 | 01·1 | 02·8 | 01·1 | 02·8 | 01·2 | 02·7 | 01·2 | 02·7 | 01·3 |
| 4 | 03·7 | 01·4 | 03·7 | 01·5 | 03·7 | 01·6 | 03·7 | 01·6 | 03·6 | 01·7 |
| 5 | 04·7 | 01·8 | 04·6 | 01·9 | 04·6 | 02·0 | 04·6 | 02·0 | 04·5 | 02·1 |
| 6 | 05·6 | 02·2 | 05·6 | 02·2 | 05·5 | 02·3 | 05·5 | 02·4 | 05·4 | 02·5 |
| 7 | 06·5 | 02·5 | 06·5 | 02·6 | 06·4 | 02·7 | 06·4 | 02·8 | 06·3 | 03·0 |
| 8 | 07·5 | 02·9 | 07·4 | 03·0 | 07·4 | 03·1 | 07·3 | 03·3 | 07·3 | 03·4 |
| 9 | 08·4 | 03·2 | 08·3 | 03·4 | 08·3 | 03·5 | 08·2 | 03·7 | 08·2 | 03·8 |
| 10 | 09·3 | 03·6 | 09·3 | 03·7 | 09·2 | 03·9 | 09·1 | 04·1 | 09·1 | 04·2 |
| 20 | 18·7 | 07·2 | 18·5 | 07·5 | 18·4 | 07·8 | 18·3 | 08·1 | 18·1 | 08·5 |
| 30 | 28·0 | 10·8 | 27·8 | 11·2 | 27·6 | 11·7 | 27·4 | 12·2 | 27·2 | 12·7 |
| 40 | 37·3 | 14·3 | 37·1 | 15·0 | 36·8 | 15·6 | 36·5 | 16·3 | 36·3 | 16·9 |
| 50 | 46·7 | 17·9 | 46·4 | 18·7 | 46·0 | 19·5 | 45·7 | 20·3 | 45·3 | 21·1 |
| 60 | 56·0 | 21·5 | 55·6 | 22·5 | 55·2 | 23·4 | 54·8 | 24·4 | 54·4 | 25·4 |
| 70 | 65·4 | 25·1 | 64·9 | 26·2 | 64·4 | 27·4 | 63·9 | 28·5 | 63·4 | 29·6 |
| 80 | 74·7 | 28·7 | 74·2 | 30·0 | 73·6 | 31·3 | 73·1 | 32·5 | 72·5 | 33·8 |
| 90 | 84·0 | 32·3 | 83·4 | 33·7 | 82·8 | 35·2 | 82·2 | 36·6 | 81·6 | 38·0 |
| 100 | 93·4 | 35·8 | 92·7 | 37·5 | 92·1 | 39·1 | 91·4 | 40·7 | 90·6 | 42·3 |
| 200 | 186·7 | 71·7 | 185·4 | 74·9 | 184·1 | 78·1 | 182·7 | 81·3 | 181·3 | 84·5 |
| 300 | 280·1 | 107·5 | 278·2 | 112·4 | 276·2 | 117·2 | 274·1 | 122·0 | 271·9 | 126·8 |
| 400 | 373·4 | 143·3 | 370·9 | 149·8 | 368·2 | 156·3 | 365·4 | 162·7 | 362·5 | 169·0 |
| 500 | 466·8 | 179·2 | 463·6 | 187·3 | 460·3 | 195·4 | 456·8 | 203·4 | 453·2 | 211·3 |
| 600 | 560·1 | 215·0 | 556·3 | 224·8 | 552·3 | 234·4 | 548·1 | 244·0 | 543·8 | 253·6 |
| 700 | 653·5 | 250·9 | 649·0 | 262·2 | 644·4 | 273·5 | 639·5 | 284·7 | 634·4 | 295·8 |
| 800 | 746·9 | 286·7 | 741·7 | 299·7 | 736·4 | 312·6 | 730·8 | 325·4 | 725·0 | 338·1 |
| 900 | 840·2 | 322·5 | 834·5 | 337·1 | 828·5 | 351·7 | 822·2 | 366·1 | 815·7 | 380·4 |
| D. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| | 69 Deg. | | 68 Deg. | | 67 Deg. | | 66 Deg. | | 65 Deg. | |

TABLE XXI.—(*continued*).

TRAVERSE TABLE: *Difference of Latitude and Departure.*

| D. | 26 Deg. | | 27 Deg. | | 28 Deg. | | 29 Deg. | | 30 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 00·9 | 00·4 | 00·9 | 00·5 | 00·9 | 00·5 | 00·9 | 00·5 | 00·9 | 00·5 |
| 2 | 01·8 | 00·9 | 01·8 | 00·9 | 01·8 | 00·9 | 01·7 | 01·0 | 01·7 | 01·0 |
| 3 | 02·7 | 01·3 | 02·7 | 01·4 | 02·6 | 01·4 | 02·6 | 01·5 | 02·6 | 01·5 |
| 4 | 03·6 | 01·8 | 03·6 | 01·8 | 03·5 | 01·9 | 03·5 | 01·9 | 03·5 | 02·0 |
| 5 | 04·5 | 02·2 | 04·5 | 02·3 | 04·4 | 02·3 | 04·4 | 02·4 | 04·3 | 02·5 |
| 6 | 05·4 | 02·6 | 05·3 | 02·7 | 05·3 | 02·8 | 05·2 | 02·9 | 05·2 | 03·0 |
| 7 | 06·3 | 03·1 | 06·2 | 03·2 | 06·2 | 03·3 | 06·1 | 03·4 | 06·1 | 03·5 |
| 8 | 07·2 | 03·5 | 07·1 | 03·6 | 07·1 | 03·8 | 07·0 | 03·9 | 06·9 | 04·0 |
| 9 | 08·1 | 03·9 | 08·0 | 04·1 | 07·9 | 04·2 | 07·9 | 04·4 | 07·8 | 04·5 |
| 10 | 09·0 | 04·4 | 08·9 | 04·5 | 08·8 | 04·7 | 08·7 | 04·8 | 08·7 | 05·0 |
| 20 | 18·0 | 08·8 | 17·8 | 09·1 | 17·7 | 09·4 | 17·5 | 09·7 | 17·3 | 10·0 |
| 30 | 27·0 | 13·2 | 26·7 | 13·6 | 26·5 | 14·1 | 26·2 | 14·5 | 26·0 | 15·0 |
| 40 | 36·0 | 17·5 | 35·6 | 18·2 | 35·3 | 18·8 | 35·0 | 19·4 | 34·6 | 20·0 |
| 50 | 44·9 | 21·9 | 44·6 | 22·7 | 44·1 | 23·5 | 43·7 | 24·2 | 43·3 | 25·0 |
| 60 | 53·9 | 26·3 | 53·5 | 27·2 | 53·0 | 28·2 | 52·5 | 29·1 | 52·0 | 30·0 |
| 70 | 62·9 | 30·7 | 62·4 | 31·8 | 61·8 | 32·9 | 61·2 | 33·9 | 60·6 | 35·0 |
| 80 | 71·9 | 35·1 | 71·3 | 36·3 | 70·6 | 37·6 | 70·0 | 38·8 | 69·3 | 40·0 |
| 90 | 80·9 | 39·5 | 80·2 | 40·9 | 79·5 | 42·3 | 78·7 | 43·6 | 77·9 | 45·0 |
| 100 | 89·9 | 43·8 | 89·1 | 45·4 | 88·3 | 46·9 | 87·5 | 48·5 | 86·6 | 50·0 |
| 200 | 179·8 | 87·7 | 178·2 | 90·8 | 176·6 | 93·9 | 174·9 | 97·0 | 173·2 | 100 0 |
| 300 | 269·6 | 131·5 | 267·3 | 136·2 | 264·9 | 140·8 | 262·4 | 145·4 | 259·8 | 150·0 |
| 400 | 359·5 | 175·3 | 356·4 | 181·6 | 353·2 | 187·8 | 349·8 | 193·9 | 346·4 | 200·0 |
| 500 | 449·4 | 219·2 | 445·5 | 227·0 | 441·5 | 234·7 | 437·3 | 242·4 | 433·0 | 250·0 |
| 600 | 539·3 | 263·0 | 534·6 | 272·4 | 529·8 | 281·7 | 524·8 | 290·9 | 519·6 | 300·0 |
| 700 | 629·2 | 306·9 | 623·7 | 317·8 | 618·1 | 328·6 | 612·2 | 339·4 | 606·2 | 350·0 |
| 800 | 719·0 | 350·7 | 712·8 | 363·2 | 706·4 | 375·6 | 699·7 | 387·8 | 692·8 | 400·0 |
| 900 | 808·9 | 394·5 | 801·9 | 408·6 | 794·7 | 422·5 | 787·2 | 436·3 | 779·4 | 450·0 |
| D. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| | 64 Deg. | | 63 Deg. | | 62 Deg. | | 61 Deg. | | 60 Deg. | |

## TABLE XXI.—(*continued*).

Traverse Table : *Difference of Latitude and Departure.*

| D. | 31 Deg. | | 32 Deg. | | 33 Deg. | | 34 Deg. | | 35 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 00·9 | 00·5 | 00·8 | 00·5 | 00·8 | 00·5 | 00·8 | 00·6 | 00·8 | 00·6 |
| 2 | 01·7 | 01·0 | 01·7 | 01·1 | 01·7 | 01·1 | 01·7 | 01·1 | 01·6 | 01·1 |
| 3 | 02·6 | 01·5 | 02·5 | 01·6 | 02·5 | 01·6 | 02·5 | 01·7 | 02·5 | 01·7 |
| 4 | 03·4 | 02·1 | 03·4 | 02·1 | 03·4 | 02·2 | 03·3 | 02·2 | 03·3 | 02·3 |
| 5 | 04·3 | 02·6 | 04·2 | 02·6 | 04·2 | 02·7 | 04·1 | 02·8 | 04·1 | 02·9 |
| 6 | 05·1 | 03·1 | 05·1 | 03·2 | 05·0 | 03·3 | 05·0 | 03·4 | 04·9 | 03·4 |
| 7 | 06·0 | 03·6 | 05·9 | 03·7 | 05·9 | 03·8 | 05·8 | 03·9 | 05·7 | 04·0 |
| 8 | 06·9 | 04·1 | 06·8 | 04·2 | 06·7 | 04·4 | 06·6 | 04·5 | 06·6 | 04·6 |
| 9 | 07·7 | 04·6 | 07·6 | 04·8 | 07·5 | 04·9 | 07·5 | 05·0 | 07·4 | 05·2 |
| 10 | 08·6 | 05·2 | 08·5 | 05·3 | 08·4 | 05·4 | 08·3 | 05·6 | 08·2 | 05·7 |
| 20 | 17·1 | 10·3 | 17·0 | 10·6 | 16·8 | 10·9 | 16·6 | 11·2 | 16·4 | 11·5 |
| 30 | 25·7 | 15·5 | 25·4 | 15·9 | 25·2 | 16·3 | 24·9 | 16·8 | 24·6 | 17·2 |
| 40 | 34·3 | 20·6 | 33·9 | 21·2 | 33·5 | 21·8 | 33·2 | 22·4 | 32·8 | 22·9 |
| 50 | 42·9 | 25·8 | 42·4 | 26·5 | 41·9 | 27·2 | 41·5 | 28·0 | 41·0 | 28·7 |
| 60 | 51·4 | 30·9 | 50·9 | 31·8 | 50·3 | 32·7 | 49·7 | 33·6 | 49·1 | 34·4 |
| 70 | 60·0 | 36·1 | 59·4 | 37·1 | 58·7 | 38·1 | 58·0 | 39·1 | 57·3 | 40·2 |
| 80 | 68·6 | 41·2 | 67·8 | 42·4 | 67·1 | 43·6 | 66·3 | 44·7 | 65·5 | 45·9 |
| 90 | 77·1 | 46·4 | 76·3 | 47·7 | 75·5 | 49·0 | 74·6 | 50·3 | 73·7 | 51·6 |
| 100 | 85·7 | 51·5 | 84·8 | 53·0 | 83·9 | 54·5 | 82·9 | 55·9 | 81·9 | 57·4 |
| 200 | 171·4 | 103·0 | 169·6 | 106·0 | 167·7 | 108·9 | 165·8 | 111·8 | 163·8 | 114·7 |
| 300 | 257·2 | 154·5 | 254·4 | 159·0 | 251·6 | 163·4 | 248·7 | 167·8 | 245·7 | 172·1 |
| 400 | 342·9 | 206·0 | 339·2 | 212·0 | 335·5 | 217·9 | 331·6 | 223·7 | 327·7 | 229·4 |
| 500 | 428·6 | 257·5 | 424·0 | 265·0 | 419·3 | 272·3 | 414·5 | 279·6 | 409·6 | 286·8 |
| 600 | 514·3 | 309·0 | 508·8 | 318·0 | 503·2 | 326·8 | 497·4 | 335·5 | 491·5 | 344·1 |
| 700 | 600·0 | 360·5 | 593·6 | 370·9 | 587·1 | 381·2 | 580·3 | 391·4 | 573·4 | 401·5 |
| 800 | 685·7 | 412·0 | 678·4 | 423·9 | 670·9 | 435·7 | 663·2 | 447·4 | 655·3 | 458·9 |
| 900 | 771·5 | 463·5 | 763·2 | 476·9 | 754·8 | 490·2 | 746·1 | 503·3 | 737·2 | 516·2 |
| D. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| | 59 Deg. | | 58 Deg. | | 57 Deg. | | 56 Deg. | | 55 Deg. | |

TABLE XXI.—(*continued*).

TRAVERSE TABLE: *Difference of Latitude and Departure.*

| D. | 36 Deg. | | 37 Deg. | | 38 Deg. | | 39 Deg. | | 40 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 00·8 | 00·6 | 00·8 | 00·6 | 00·8 | 00·6 | 00·8 | 00·6 | 00·8 | 00·6 |
| 2 | 01·6 | 01·2 | 01·6 | 01·2 | 01·6 | 01·2 | 01·6 | 01·3 | 01·5 | 01·3 |
| 3 | 02·4 | 01·8 | 02·4 | 01·8 | 02·4 | 01·8 | 02·3 | 01·9 | 02·3 | 01·9 |
| 4 | 03·2 | 02·4 | 03·2 | 02·4 | 03·2 | 02·5 | 03·1 | 02·5 | 03·1 | 02·6 |
| 5 | 04·0 | 02·9 | 04·0 | 03·0 | 03·9 | 03·1 | 03·9 | 03·1 | 03·8 | 03·2 |
| 6 | 04·9 | 03·5 | 04·8 | 03·6 | 04·7 | 03·7 | 04·7 | 03·8 | 04·6 | 03·9 |
| 7 | 05·7 | 04·1 | 05·6 | 04·2 | 05·5 | 04·3 | 05·4 | 04·4 | 05·4 | 04·5 |
| 8 | 06·5 | 04·7 | 06·4 | 04·8 | 06·3 | 04·9 | 06·2 | 05·0 | 06·1 | 05·1 |
| 9 | 07·3 | 05·3 | 07·2 | 05·4 | 07·1 | 05·5 | 07·0 | 05·7 | 06·9 | 05·8 |
| 10 | 08·1 | 05·9 | 08·0 | 06·0 | 07·9 | 06·2 | 07·8 | 06·3 | 07·7 | 06·4 |
| 20 | 16·2 | 11·8 | 16·0 | 12·0 | 15·8 | 12·3 | 15·5 | 12·6 | 15·3 | 12·9 |
| 30 | 24·3 | 17·6 | 24·0 | 18·1 | 23·6 | 18·5 | 23·3 | 18·9 | 23·0 | 19·3 |
| 40 | 32·4 | 23·5 | 31·9 | 24·1 | 31·5 | 24·6 | 31·1 | 25·2 | 30·6 | 25·7 |
| 50 | 40·5 | 29·4 | 39·9 | 30·1 | 39·4 | 30·8 | 38·9 | 31·5 | 38·3 | 32·1 |
| 60 | 48·5 | 35·3 | 47·9 | 36·1 | 47·3 | 36·9 | 46·6 | 37·8 | 46·0 | 38·6 |
| 70 | 56·6 | 41·1 | 55·9 | 42·1 | 55·2 | 43·1 | 54·4 | 44·1 | 53·6 | 45·0 |
| 80 | 64·7 | 47·0 | 63·9 | 48·1 | 63·0 | 49·3 | 62·2 | 50·3 | 61·3 | 51·4 |
| 90 | 72·8 | 52·9 | 71·9 | 54·2 | 70·9 | 55·4 | 69·9 | 56·6 | 68·9 | 57·9 |
| 100 | 80·9 | 58·8 | 79·9 | 60·2 | 78·8 | 61·6 | 77·7 | 62·9 | 76·6 | 64·3 |
| 200 | 161·8 | 117·6 | 159·7 | 120·4 | 157·6 | 123·1 | 155·4 | 125·9 | 153·2 | 128·6 |
| 300 | 242·7 | 176·3 | 239·6 | 180·5 | 236·4 | 184·7 | 233·1 | 188·8 | 229·8 | 192·8 |
| 400 | 323·6 | 235·1 | 319·5 | 240·7 | 315·2 | 246·3 | 310·9 | 251·7 | 306·4 | 257·1 |
| 500 | 404·5 | 293·9 | 399·3 | 300·9 | 394·0 | 307·8 | 388·6 | 314·7 | 383·0 | 321·4 |
| 600 | 485·4 | 352·7 | 479·2 | 361·1 | 472·8 | 369·4 | 466·3 | 377·6 | 459·6 | 385·7 |
| 700 | 566·3 | 411·4 | 559·0 | 421·3 | 551·6 | 431·0 | 544·0 | 440·5 | 536·2 | 450·0 |
| 800 | 647·2 | 470·2 | 638·9 | 481·5 | 630·4 | 492·5 | 621·7 | 503·5 | 612·8 | 514·2 |
| 900 | 728·1 | 529·0 | 718·8 | 541·6 | 709·2 | 554·1 | 699·4 | 566·4 | 689·4 | 578·5 |
| D. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| | 54 Deg. | | 53 Deg. | | 52 Deg. | | 51 Deg. | | 50 Deg. | |

## TABLE XXI.—(*continued*).

TRAVERSE TABLE: *Difference of Latitude and Departure.*

| D. | 41 Deg. | | 42 Deg. | | 43 Deg. | | 44 Deg. | | 45 Deg. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. |
| 1 | 00·8 | 00·7 | 00·7 | 00·7 | 00·7 | 00·7 | 00·7 | 00·7 | 00·7 | 00·7 |
| 2 | 01·5 | 01·3 | 01·5 | 01·3 | 01·5 | 01·4 | 01·4 | 01·4 | 01·4 | 01·4 |
| 3 | 02·3 | 02·0 | 02·2 | 02·0 | 02·2 | 02·0 | 02·2 | 02·1 | 02·1 | 02·1 |
| 4 | 03·0 | 02·6 | 03·0 | 02·7 | 02·9 | 02·7 | 02·9 | 02·8 | 02·8 | 02·8 |
| 5 | 03·8 | 03·3 | 03·7 | 03·3 | 03·7 | 03·4 | 03·6 | 03·5 | 03·5 | 03·5 |
| 6 | 04·5 | 03·9 | 04·5 | 04·0 | 04·4 | 04·1 | 04·3 | 04·2 | 04·2 | 04·2 |
| 7 | 05·3 | 04·6 | 05·2 | 04·7 | 05·1 | 04·8 | 05·0 | 04·9 | 04·9 | 04·9 |
| 8 | 06· | 05·2 | 05·9 | 05·4 | 05·9 | 05·5 | 05·8 | 05·6 | 05·7 | 05·7 |
| 9 | 06·8 | 05·9 | 06·7 | 06·0 | 06·6 | 06·1 | 06·5 | 06·3 | 06·4 | 06·4 |
| 10 | 07·5 | 06·6 | 07 4 | 06·7 | 07·3 | 06·8 | 07·2 | 06·9 | 07·1 | 07·1 |
| 20 | 15·1 | 13·1 | 14·9 | 13·4 | 14·6 | 13·6 | 14·4 | 13·9 | 14·1 | 14·1 |
| 30 | 22·6 | 19·7 | 22·3 | 20·1 | 21·9 | 20·5 | 21·6 | 20·8 | 21·2 | 21·2 |
| 40 | 30·2 | 26·2 | 29·7 | 26·8 | 29·3 | 27·3 | 28·8 | 27·8 | 28·3 | 28·3 |
| 50 | 37·7 | 32·8 | 37·2 | 33·5 | 36·6 | 34·1 | 36·0 | 34·7 | 35·4 | 35·4 |
| 60 | 45·3 | 39·4 | 44·6 | 40·1 | 43·9 | 40·9 | 43·2 | 41·7 | 42·4 | 42·4 |
| 70 | 52·8 | 45·9 | 52·0 | 46·8 | 51·2 | 47·7 | 50·4 | 48·6 | 49·5 | 49·5 |
| 80 | 60·4 | 52·5 | 59·5 | 53·5 | 58·5 | 54·6 | 57·5 | 55·6 | 56·6 | 56·6 |
| 90 | 67·9 | 59·0 | 66·9 | 60·2 | 65·8 | 61·4 | 64·7 | 62·5 | 63·6 | 63·6 |
| 100 | 75·5 | 65·6 | 74·3 | 66·9 | 73·1 | 68·2 | 71·9 | 69·5 | 70·7 | 70·7 |
| 200 | 150·9 | 131·2 | 148·6 | 133·8 | 146·3 | 136·4 | 143·9 | 138·9 | 141·4 | 141·4 |
| 300 | 226·4 | 196·8 | 222·9 | 200·7 | 219·4 | 204·6 | 215·8 | 208·4 | 212·1 | 212·1 |
| 400 | 301·9 | 262·4 | 297·3 | 267·7 | 292·5 | 272·8 | 287·7 | 277·9 | 282·8 | 282·8 |
| 500 | 377·4 | 328·0 | 371·6 | 334·6 | 365·7 | 341·0 | 359·7 | 347·3 | 353·6 | 353·6 |
| 600 | 452·8 | 393·6 | 445·9 | 401·5 | 438·8 | 409·2 | 431·6 | 416·8 | 424·3 | 424·3 |
| 700 | 528·3 | 459·2 | 520·2 | 468·4 | 511·9 | 477·4 | 503·5 | 486·3 | 495·0 | 495·0 |
| 800 | 603·8 | 524·8 | 594·5 | 535·3 | 585·1 | 545·6 | 575·5 | 555·7 | 565·7 | 565·7 |
| 900 | 679·2 | 590·5 | 668·8 | 602·2 | 658·2 | 613·8 | 647·4 | 625·2 | 636·4 | 636·4 |
| | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. | Dep. | Lat. |
| D. | 49 Deg. | | 48 Deg. | | 47 Deg. | | 46 Deg. | | 45 Deg. | |

## TABLE XXII.

| T′ = Approx. Long. in Time. | | B = Mean of Second Differences. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1m | 2m | 3m | 4m | 5m | 6m | 7m | 8m | 9m | 10m | 11m | 12m |
| H. M. | H. M. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. |
| 0. 0 | 12. 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.10 | 11.50 | 0.4 | 0.8 | 1.2 | 1.6 | 2.1 | 2.5 | 2.9 | 3.3 | 3.7 | 4.1 | 4.5 | 4.9 |
| 0.20 | 11.40 | 0.8 | 1.6 | 2.4 | 3.2 | 4.1 | 4.9 | 5.7 | 6.5 | 7.3 | 8.1 | 8.9 | 9.7 |
| 0.30 | 11.30 | 1.2 | 2.4 | 3.6 | 4.8 | 6.0 | 7.2 | 8.4 | 9.6 | 10.8 | 12.0 | 13.2 | 14.4 |
| 0.40 | 11.20 | 1.6 | 3.1 | 4.7 | 6.3 | 7.9 | 9.4 | 11.0 | 12.6 | 14.2 | 15.7 | 17.3 | 18.9 |
| 0.50 | 11.10 | 1.9 | 3.9 | 5.8 | 7.8 | 9.7 | 11.6 | 13.6 | 15.5 | 17.4 | 19.4 | 21.3 | 23.3 |
| 1. 0 | 11. 0 | 2.3 | 4.6 | 6.9 | 9.2 | 11.5 | 13.7 | 16.0 | 18.3 | 20.6 | 22.9 | 25.2 | 27.5 |
| 1.10 | 10.50 | 2.6 | 5.3 | 7.9 | 10.5 | 13.2 | 15.8 | 18.4 | 21.1 | 23.7 | 26.3 | 29.0 | 31.6 |
| 1.20 | 10.40 | 3.0 | 5.9 | 8.9 | 11.9 | 14.8 | 17.8 | 20.7 | 23.7 | 26.7 | 29.6 | 32.6 | 35.6 |
| 1.30 | 10.30 | 3.3 | 6.6 | 9.8 | 13.1 | 16.4 | 19.7 | 23.0 | 26.2 | 29.5 | 32.8 | 36.1 | 39.4 |
| 1.40 | 10.20 | 3.6 | 7.2 | 10.8 | 14.4 | 17.9 | 21.5 | 25.1 | 28.7 | 32.3 | 35.9 | 39.5 | 43.1 |
| 1.50 | 10.10 | 3.9 | 7.8 | 11.6 | 15.5 | 19.4 | 23.3 | 27.2 | 31.1 | 34.9 | 38.8 | 42.7 | 46.6 |
| 2. 0 | 10. 0 | 4.2 | 8.3 | 12.5 | 16.7 | 20.8 | 25.0 | 29.2 | 33.3 | 37.5 | 41.7 | 45.8 | 50.0 |
| 2.10 | 9.50 | 4.4 | 8.9 | 13.3 | 17.8 | 22.2 | 26.6 | 31.1 | 35.5 | 39.9 | 44.4 | 48.8 | 53.3 |
| 2.20 | 9.40 | 4.7 | 9.4 | 14.1 | 18.8 | 23.5 | 28.2 | 32.9 | 37.6 | 42.3 | 47.0 | 51.7 | 56.4 |
| 2.30 | 9.30 | 4.9 | 9.9 | 14.8 | 19.8 | 24.7 | 29.7 | 34.6 | 39.6 | 44.5 | 49.5 | 54.4 | 59.4 |
| 2.40 | 9.20 | 5.2 | 10.4 | 15.6 | 20.7 | 25.9 | 31.1 | 36.3 | 41.5 | 46.7 | 51.9 | 57.0 | 62.2 |
| 2.50 | 9.10 | 5.4 | 10.8 | 16.2 | 21.6 | 27.1 | 32.5 | 37.9 | 43.3 | 48.7 | 54.1 | 49.5 | 64.9 |
| 3. 0 | 9. 0 | 5.6 | 11.2 | 16.9 | 22.5 | 28.1 | 33.7 | 39.4 | 45.0 | 50.6 | 56.2 | 61.9 | 67.5 |
| 3.10 | 8.50 | 5.8 | 11.7 | 17.5 | 23.3 | 29.1 | 35.0 | 40.8 | 46.6 | 52.4 | 58.3 | 64.1 | 69.9 |
| 3.20 | 8.40 | 6.0 | 12.0 | 18.1 | 24.1 | 30.1 | 36.1 | 42.1 | 48.1 | 54.2 | 60.2 | 66.2 | 72.2 |
| 3.30 | 8.30 | 6.2 | 12.4 | 18.6 | 24.8 | 31.0 | 37.2 | 43.4 | 49.6 | 55.8 | 62.0 | 68.2 | 74.4 |
| 3.40 | 8.20 | 6.4 | 12.7 | 19.1 | 25.5 | 31.8 | 38.2 | 44.6 | 50.9 | 57.3 | 63.7 | 70.0 | 76.4 |
| 3.50 | 8.10 | 6.5 | 13.0 | 19.6 | 26.1 | 32.6 | 39.1 | 45.7 | 52.2 | 58.7 | 65.2 | 71.7 | 78.3 |
| 4. 0 | 8. 0 | 6.7 | 13.3 | 20.0 | 26.7 | 33.3 | 40.0 | 46.7 | 53.3 | 60.0 | 66.7 | 73.3 | 80.0 |
| 4.20 | 7.40 | 6.9 | 13.8 | 20.8 | 27.7 | 34.6 | 41.5 | 48.4 | 55.4 | 62.3 | 69.2 | 76.1 | 83.1 |
| 4.40 | 7.20 | 7.1 | 14.3 | 21.4 | 28.5 | 35.6 | 42.8 | 49.9 | 57.0 | 64.2 | 71.3 | 78.4 | 85.6 |
| 5. 0 | 7. 0 | 7.3 | 14.6 | 21.9 | 29.2 | 36.5 | 43.7 | 51.0 | 58.3 | 65.6 | 72.9 | 80.2 | 87.5 |
| 5.20 | 6.40 | 7.4 | 14.8 | 22.2 | 29.6 | 37.0 | 44.4 | 51.9 | 59.3 | 66.7 | 74.1 | 81.5 | 88.9 |
| 5.40 | 6.20 | 7.5 | 15.0 | 22.4 | 29.9 | 37.4 | 44.9 | 52.3 | 59.8 | 67.3 | 74.8 | 82.2 | 89.7 |
| 6. 0 | 6. 0 | 7.5 | 15.0 | 22.5 | 30.0 | 37.5 | 45.0 | 52.5 | 60.0 | 67.5 | 75.0 | 82.5 | 90.0 |

TABLE XXII.—(*continued*).

| T′ = Approx. Long. in Time. | | B = Mean of Second Differences. | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 sec | 20 sec | 30 sec | 40 sec | 50 sec | 1 sec | 2 sec | 3 sec | 4 sec | 5 sec | 6 sec | 7 sec | 8 sec | 9 sec |
| H. M. | H. M. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. | Sec. |
| 0. 0 | 12. 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.10 | 11.50 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| 0.20 | 11.40 | 0.1 | 0.3 | 0.4 | 0.5 | 0.7 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 0.30 | 11.30 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| 0.40 | 11.20 | 0.3 | 0.5 | 0.8 | 1.0 | 1.3 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| 0.50 | 11.10 | 0.3 | 0.6 | 1.0 | 1.3 | 1.6 | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 |
| 1. 0 | 11. 0 | 0.4 | 0.8 | 1.1 | 1.5 | 1.9 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| 1.10 | 10.50 | 0.4 | 0.9 | 1.3 | 1.8 | 2.2 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| 1.20 | 10.40 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| 1.30 | 10.30 | 0.5 | 1.1 | 1.6 | 2.2 | 2.7 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 |
| 1.40 | 10.20 | 0.6 | 1.2 | 1.8 | 2.4 | 3.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 |
| 1.50 | 10.10 | 0.6 | 1.3 | 1.9 | 2.6 | 3.2 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.5 | 0.6 |
| 2. 0 | 10. 0 | 0.7 | 1.4 | 2.1 | 2.8 | 3.5 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 0.6 |
| 2.10 | 9.50 | 0.7 | 1.5 | 2.2 | 3.0 | 3.7 | 0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 |
| 2.20 | 9.40 | 0.8 | 1.6 | 2.3 | 3.1 | 3.9 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 | 0.6 | 0.7 |
| 2.30 | 9.30 | 0.8 | 1.6 | 2.5 | 3.3 | 4.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 |
| 2.40 | 9.20 | 0.9 | 1.7 | 2.6 | 3.5 | 4.3 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 |
| 2.50 | 9.10 | 0.9 | 1.8 | 2.7 | 3.6 | 4.5 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 | 0.6 | 0.7 | 0.8 |
| 3. 0 | 9. 0 | 0.9 | 1.9 | 2.8 | 3.7 | 4.7 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 | 0.8 |
| 3.10 | 8.50 | 1.0 | 1.9 | 2.9 | 3.9 | 4.9 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 3.20 | 8.40 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 3.30 | 8.30 | 1.0 | 2.1 | 3.1 | 4.1 | 5.2 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| 3.40 | 8.20 | 1.1 | 2.1 | 3.2 | 4.2 | 5.3 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 |
| 3.50 | 8.10 | 1.1 | 2.2 | 3.3 | 4.3 | 5.4 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.7 | 0.8 | 0.9 | 1.0 |
| 4. 0 | 8. 0 | 1.1 | 2.2 | 3.3 | 4.4 | 5.6 | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 4.20 | 7.40 | 1.2 | 2.3 | 3.5 | 4.6 | 5.8 | 0.1 | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 4.40 | 7.20 | 1.2 | 2.4 | 3.6 | 4.8 | 5.9 | 0.1 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | 1.1 |
| 5. 0 | 7. 0 | 1.2 | 2.4 | 3.6 | 4.9 | 6.1 | 0.1 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.9 | 1.0 | 1.1 |
| 6. 0 | 6. 0 | 1.2 | 2.5 | 3.7 | 5.0 | 6.2 | 0.1 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.9 | 1.0 | 1.1 |

## TABLE XXIII.

### ANGLES SUBTENDED BY A 10-FT. ROD AT DISTANCES FROM 50 TO 1500 FEET.

| Feet. | Angle. | | | Feet. | Angle. | | | Feet. | Angle. | | | Feet. | Angle. | | | Feet. | Angle. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ′ | ″ | | ° | ′ | ″ | | ° | ′ | ″ | | ° | ′ | ″ | | ° | ′ | ″ |
| 50 | 11 | 27 | 33 | 97 | 5 | 54 | 24 | 144 | 3 | 58 | 44 | 191 | 2 | 59 | 59 | 276 | 2 | 4 | 33 |
| 51 | 11 | 14 | 4 | 98 | 5 | 50 | 47 | 145 | 3 | 57 | 5 | 192 | 2 | 59 | 3 | 278 | 2 | 3 | 39 |
| 52 | 11 | 1 | 7 | 99 | 5 | 47 | 15 | 146 | 3 | 55 | 28 | 193 | 2 | 58 | 7 | 280 | 2 | 2 | 46 |
| 53 | 10 | 48 | 38 | 100 | 5 | 43 | 46 | 147 | 3 | 53 | 51 | 194 | 2 | 57 | 12 | 282 | 2 | 1 | 54 |
| 54 | 10 | 36 | 34 | 101 | 5 | 40 | 27 | 148 | 3 | 52 | 17 | 195 | 2 | 56 | 18 | 284 | 2 | 1 | 2 |
| 55 | 10 | 25 | 3 | 102 | 5 | 37 | 32 | 149 | 3 | 50 | 43 | 196 | 2 | 55 | 23 | 286 | 2 | 0 | 12 |
| 56 | 10 | 13 | 53 | 103 | 5 | 33 | 45 | 150 | 3 | 49 | 11 | 197 | 2 | 54 | 36 | 288 | 1 | 59 | 22 |
| 57 | 10 | 3 | 7 | 104 | 5 | 30 | 33 | 151 | 3 | 47 | 38 | 198 | 2 | 53 | 37 | 290 | 1 | 58 | 32 |
| 58 | 9 | 52 | 43 | 105 | 5 | 27 | 24 | 152 | 3 | 46 | 10 | 199 | 2 | 52 | 49 | 292 | 1 | 57 | 44 |
| 59 | 9 | 42 | 40 | 106 | 5 | 24 | 19 | 153 | 3 | 44 | 41 | 200 | 2 | 51 | 53 | 294 | 1 | 56 | 55 |
| 60 | 9 | 32 | 58 | 107 | 5 | 21 | 17 | 154 | 3 | 43 | 12 | 202 | 2 | 50 | 13 | 296 | 1 | 56 | 8 |
| 61 | 9 | 23 | 34 | 108 | 5 | 18 | 17 | 155 | 3 | 41 | 47 | 204 | 2 | 48 | 46 | 298 | 1 | 55 | 21 |
| 62 | 9 | 14 | 28 | 109 | 5 | 15 | 23 | 156 | 3 | 40 | 22 | 206 | 2 | 46 | 47 | 300 | 1 | 54 | 35 |
| 63 | 9 | 5 | 42 | 110 | 5 | 12 | 31 | 157 | 3 | 38 | 58 | 208 | 2 | 45 | 16 | 302 | 1 | 53 | 49 |
| 64 | 8 | 57 | 9 | 111 | 5 | 9 | 42 | 158 | 3 | 37 | 34 | 210 | 2 | 43 | 42 | 304 | 1 | 53 | 5 |
| 65 | 8 | 48 | 53 | 112 | 5 | 6 | 56 | 159 | 3 | 36 | 12 | 212 | 2 | 42 | 9 | 306 | 1 | 52 | 20 |
| 66 | 8 | 40 | 52 | 113 | 5 | 4 | 13 | 160 | 3 | 34 | 51 | 214 | 2 | 40 | 38 | 308 | 1 | 51 | 36 |
| 67 | 8 | 33 | 6 | 114 | 5 | 1 | 33 | 161 | 3 | 33 | 31 | 216 | 2 | 39 | 8 | 310 | 1 | 50 | 53 |
| 68 | 8 | 25 | 33 | 115 | 4 | 58 | 56 | 162 | 3 | 32 | 12 | 218 | 2 | 37 | 41 | 312 | 1 | 50 | 11 |
| 69 | 8 | 18 | 13 | 116 | 4 | 56 | 21 | 163 | 3 | 30 | 54 | 220 | 2 | 36 | 16 | 314 | 1 | 49 | 29 |
| 70 | 8 | 11 | 7 | 117 | 4 | 53 | 50 | 164 | 3 | 29 | 37 | 222 | 2 | 34 | 51 | 316 | 1 | 48 | 47 |
| 71 | 8 | 4 | 11 | 118 | 4 | 51 | 20 | 165 | 3 | 28 | 21 | 224 | 2 | 33 | 28 | 318 | 1 | 48 | 6 |
| 72 | 7 | 57 | 28 | 119 | 4 | 48 | 57 | 166 | 3 | 27 | 5 | 226 | 2 | 32 | 6 | 320 | 1 | 47 | 25 |
| 73 | 7 | 50 | 56 | 120 | 4 | 46 | 29 | 167 | 3 | 25 | 52 | 228 | 2 | 30 | 46 | 322 | 1 | 46 | 45 |
| 74 | 7 | 44 | 34 | 121 | 4 | 44 | 6 | 168 | 3 | 24 | 38 | 230 | 2 | 29 | 28 | 324 | 1 | 46 | 6 |
| 75 | 7 | 38 | 22 | 122 | 4 | 41 | 47 | 169 | 3 | 23 | 25 | 232 | 2 | 28 | 10 | 326 | 1 | 45 | 27 |
| 76 | 7 | 32 | 20 | 123 | 4 | 39 | 29 | 170 | 3 | 22 | 13 | 234 | 2 | 26 | 55 | 328 | 1 | 44 | 48 |
| 77 | 7 | 26 | 28 | 124 | 4 | 37 | 14 | 171 | 3 | 21 | 2 | 236 | 2 | 25 | 40 | 330 | 1 | 44 | 10 |
| 78 | 7 | 20 | 44 | 125 | 4 | 35 | 1 | 172 | 3 | 19 | 52 | 238 | 2 | 24 | 28 | 332 | 1 | 43 | 32 |
| 79 | 7 | 15 | 9 | 126 | 4 | 32 | 51 | 173 | 3 | 18 | 13 | 240 | 2 | 23 | 14 | 334 | 1 | 42 | 56 |
| 80 | 7 | 9 | 43 | 127 | 4 | 30 | 41 | 174 | 3 | 17 | 34 | 242 | 2 | 22 | 3 | 336 | 1 | 42 | 19 |
| 81 | 7 | 4 | 25 | 128 | 4 | 28 | 34 | 175 | 3 | 16 | 26 | 244 | 2 | 20 | 23 | 338 | 1 | 41 | 42 |
| 82 | 6 | 59 | 14 | 129 | 4 | 26 | 29 | 176 | 3 | 15 | 19 | 246 | 2 | 19 | 44 | 340 | 1 | 41 | 6 |
| 83 | 6 | 54 | 11 | 130 | 4 | 24 | 26 | 177 | 3 | 14 | 13 | 248 | 2 | 18 | 37 | 342 | 1 | 40 | 31 |
| 84 | 6 | 49 | 16 | 131 | 4 | 22 | 25 | 178 | 3 | 13 | 8 | 250 | 2 | 17 | 30 | 344 | 1 | 39 | 56 |
| 85 | 6 | 44 | 26 | 132 | 4 | 20 | 26 | 179 | 3 | 12 | 3 | 252 | 2 | 16 | 25 | 346 | 1 | 39 | 6 |
| 86 | 6 | 39 | 44 | 133 | 4 | 18 | 28 | 180 | 3 | 10 | 59 | 254 | 2 | 15 | 20 | 348 | 1 | 38 | 47 |
| 87 | 6 | 35 | 8 | 134 | 4 | 16 | 33 | 181 | 3 | 9 | 56 | 256 | 2 | 14 | 17 | 350 | 1 | 38 | 13 |
| 88 | 6 | 30 | 39 | 135 | 4 | 14 | 39 | 182 | 3 | 8 | 53 | 258 | 2 | 13 | 15 | 352 | 1 | 37 | 39 |
| 89 | 6 | 26 | 16 | 136 | 4 | 12 | 46 | 183 | 3 | 7 | 51 | 260 | 2 | 12 | 13 | 354 | 1 | 37 | 6 |
| 90 | 6 | 21 | 59 | 137 | 4 | 10 | 56 | 184 | 3 | 6 | 50 | 262 | 2 | 11 | 12 | 356 | 1 | 36 | 34 |
| 91 | 6 | 17 | 46 | 138 | 4 | 9 | 6 | 185 | 3 | 5 | 49 | 264 | 2 | 10 | 13 | 358 | 1 | 36 | 1 |
| 92 | 6 | 13 | 40 | 139 | 4 | 7 | 16 | 186 | 3 | 4 | 49 | 266 | 2 | 9 | 14 | 360 | 1 | 35 | 29 |
| 93 | 6 | 9 | 39 | 140 | 4 | 5 | 33 | 187 | 3 | 3 | 50 | 268 | 2 | 8 | 16 | 362 | 1 | 34 | 58 |
| 94 | 6 | 5 | 43 | 141 | 4 | 3 | 48 | 188 | 3 | 2 | 51 | 270 | 2 | 7 | 19 | 364 | 1 | 34 | 26 |
| 95 | 6 | 1 | 52 | 142 | 4 | 2 | 5 | 189 | 3 | 1 | 53 | 272 | 2 | 6 | 23 | 366 | 1 | 33 | 55 |
| 96 | 5 | 58 | 6 | 143 | 4 | 0 | 24 | 190 | 3 | 0 | 56 | 274 | 2 | 5 | 28 | 368 | 1 | 33 | 25 |

## TABLE XXIII.—(*continued*).

ANGLES SUBTENDED BY A 10-FT. ROD AT DISTANCES FROM 50 TO 1500 FEET.

| Feet. | Angle. | | | Feet. | Angle. | | | Feet. | Angle. | | | Feet. | Angle. | | | Feet. | Angle. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ′ | ″ | | ° | ′ | ″ | | ° | ′ | ″ | | ° | ′ | ″ | | ° | ′ | ″ |
| 370 | 1 | 32 | 54 | 495 | 1 | 9 | 27 | 666 | 0 | 51 | 37 | 942 | 0 | 36 | 30 | 1224 | 0 | 28 | 5 |
| 372 | 1 | 32 | 24 | 498 | 1 | 9 | 2 | 672 | 0 | 51 | 9 | 948 | 0 | 36 | 16 | 1230 | 0 | 27 | 57 |
| 374 | 1 | 31 | 55 | 501 | 1 | 8 | 37 | 678 | 0 | 50 | 42 | 954 | 0 | 36 | 2 | 1236 | 0 | 27 | 49 |
| 376 | 1 | 31 | 25 | 504 | 1 | 8 | 12 | 684 | 0 | 50 | 15 | 960 | 0 | 35 | 48 | 1242 | 0 | 27 | 41 |
| 378 | 1 | 30 | 56 | 507 | 1 | 7 | 48 | 690 | 0 | 49 | 49 | 966 | 0 | 35 | 35 | 1248 | 0 | 27 | 32 |
| 380 | 1 | 30 | 28 | 510 | 1 | 7 | 24 | 696 | 0 | 49 | 23 | 972 | 0 | 35 | 22 | 1254 | 0 | 27 | 25 |
| 382 | 1 | 29 | 59 | 513 | 1 | 7 | 1 | 702 | 0 | 48 | 56 | 978 | 0 | 35 | 9 | 1260 | 0 | 27 | 17 |
| 384 | 1 | 29 | 31 | 516 | 1 | 6 | 37 | 708 | 0 | 48 | 33 | 984 | 0 | 34 | 56 | 1266 | 0 | 27 | 9 |
| 386 | 1 | 29 | 3 | 519 | 1 | 6 | 14 | 714 | 0 | 48 | 9 | 990 | 0 | 34 | 43 | 1272 | 0 | 27 | 1 |
| 388 | 1 | 28 | 36 | 522 | 1 | 5 | 51 | 720 | 0 | 47 | 44 | 996 | 0 | 34 | 31 | 1278 | 0 | 26 | 54 |
| 390 | 1 | 28 | 9 | 525 | 1 | 5 | 29 | 726 | 0 | 47 | 21 | 1002 | 0 | 34 | 18 | 1284 | 0 | 26 | 46 |
| 392 | 1 | 27 | 41 | 528 | 1 | 5 | 6 | 732 | 0 | 46 | 57 | 1008 | 0 | 34 | 6 | 1290 | 0 | 26 | 39 |
| 394 | 1 | 27 | 18 | 531 | 1 | 4 | 45 | 738 | 0 | 46 | 35 | 1014 | 0 | 33 | 54 | 1296 | 0 | 26 | 31 |
| 396 | 1 | 26 | 48 | 534 | 1 | 4 | 22 | 744 | 0 | 46 | 12 | 1020 | 0 | 33 | 42 | 1302 | 0 | 26 | 24 |
| 398 | 1 | 26 | 24 | 537 | 1 | 4 | 1 | 750 | 0 | 45 | 50 | 1026 | 0 | 33 | 30 | 1308 | 0 | 26 | 17 |
| 400 | 1 | 25 | 56 | 540 | 1 | 3 | 39 | 756 | 0 | 45 | 28 | 1032 | 0 | 33 | 18 | 1314 | 0 | 26 | 10 |
| 402 | 1 | 25 | 31 | 543 | 1 | 3 | 19 | 762 | 0 | 45 | 7 | 1038 | 0 | 33 | 7 | 1320 | 0 | 26 | 2 |
| 405 | 1 | 24 | 53 | 546 | 1 | 2 | 58 | 768 | 0 | 44 | 46 | 1044 | 0 | 32 | 55 | 1326 | 0 | 25 | 55 |
| 408 | 1 | 24 | 15 | 549 | 1 | 2 | 37 | 774 | 0 | 44 | 25 | 1050 | 0 | 32 | 45 | 1332 | 0 | 25 | 48 |
| 411 | 1 | 23 | 38 | 552 | 1 | 2 | 16 | 780 | 0 | 44 | 4 | 1056 | 0 | 32 | 33 | 1338 | 0 | 25 | 41 |
| 414 | 1 | 23 | 2 | 555 | 1 | 1 | 56 | 786 | 0 | 43 | 44 | 1062 | 0 | 32 | 22 | 1344 | 0 | 25 | 34 |
| 417 | 1 | 22 | 26 | 558 | 1 | 1 | 36 | 792 | 0 | 43 | 24 | 1068 | 0 | 32 | 11 | 1350 | 0 | 25 | 28 |
| 420 | 1 | 21 | 51 | 561 | 1 | 1 | 17 | 798 | 0 | 43 | 5 | 1074 | 0 | 32 | 1 | 1356 | 0 | 25 | 21 |
| 423 | 1 | 21 | 16 | 564 | 1 | 0 | 57 | 804 | 0 | 42 | 45 | 1080 | 0 | 31 | 49 | 1362 | 0 | 25 | 14 |
| 426 | 1 | 20 | 42 | 567 | 1 | 0 | 38 | 810 | 0 | 42 | 26 | 1086 | 0 | 31 | 39 | 1368 | 0 | 25 | 7 |
| 429 | 1 | 20 | 8 | 570 | 1 | 0 | 19 | 816 | 0 | 42 | 7 | 1092 | 0 | 31 | 29 | 1374 | 0 | 25 | 1 |
| 432 | 1 | 19 | 35 | 573 | 1 | 0 | 0 | 822 | 0 | 41 | 49 | 1098 | 0 | 31 | 19 | 1380 | 0 | 24 | 54 |
| 435 | 1 | 19 | 2 | 576 | 0 | 59 | 41 | 828 | 0 | 41 | 31 | 1104 | 0 | 31 | 8 | 1386 | 0 | 24 | 48 |
| 438 | 1 | 18 | 29 | 579 | 0 | 59 | 22 | 834 | 0 | 41 | 13 | 1116 | 0 | 30 | 48 | 1398 | 0 | 24 | 35 |
| 441 | 1 | 17 | 57 | 582 | 0 | 59 | 4 | 840 | 0 | 40 | 55 | 1122 | 0 | 30 | 41 | 1404 | 0 | 24 | 28 |
| 444 | 1 | 17 | 26 | 585 | 0 | 58 | 46 | 846 | 0 | 40 | 38 | 1128 | 0 | 30 | 28 | 1410 | 0 | 24 | 22 |
| 447 | 1 | 16 | 54 | 588 | 0 | 58 | 27 | 852 | 0 | 40 | 21 | 1134 | 0 | 30 | 19 | 1416 | 0 | 24 | 16 |
| 450 | 1 | 16 | 24 | 591 | 0 | 58 | 10 | 858 | 0 | 40 | 4 | 1140 | 0 | 30 | 9 | 1422 | 0 | 24 | 10 |
| 453 | 1 | 15 | 53 | 594 | 0 | 57 | 52 | 864 | 0 | 39 | 47 | 1146 | 0 | 30 | 0 | 1428 | 0 | 24 | 4 |
| 456 | 1 | 15 | 23 | 597 | 0 | 57 | 35 | 870 | 0 | 39 | 31 | 1152 | 0 | 29 | 51 | 1434 | 0 | 23 | 58 |
| 459 | 1 | 14 | 54 | 600 | 0 | 57 | 17 | 876 | 0 | 39 | 14 | 1158 | 0 | 29 | 41 | 1440 | 0 | 23 | 52 |
| 462 | 1 | 14 | 24 | 606 | 0 | 56 | 44 | 882 | 0 | 38 | 58 | 1164 | 0 | 29 | 32 | 1446 | 0 | 23 | 46 |
| 465 | 1 | 13 | 56 | 612 | 0 | 56 | 10 | 888 | 0 | 38 | 43 | 1170 | 0 | 29 | 33 | 1452 | 0 | 23 | 40 |
| 468 | 1 | 13 | 27 | 618 | 0 | 55 | 38 | 894 | 0 | 38 | 27 | 1176 | 0 | 29 | 14 | 1458 | 0 | 23 | 35 |
| 471 | 1 | 12 | 59 | 624 | 0 | 55 | 5 | 900 | 0 | 38 | 12 | 1182 | 0 | 29 | 5 | 1464 | 0 | 23 | 28 |
| 474 | 1 | 12 | 32 | 630 | 0 | 54 | 34 | 906 | 0 | 37 | 56 | 1188 | 0 | 28 | 56 | 1470 | 0 | 23 | 23 |
| 477 | 1 | 12 | 24 | 636 | 0 | 54 | 3 | 912 | 0 | 37 | 41 | 1194 | 0 | 28 | 47 | 1476 | 0 | 23 | 17 |
| 480 | 1 | 11 | 37 | 642 | 0 | 53 | 33 | 918 | 0 | 37 | 27 | 1200 | 0 | 28 | 39 | 1482 | 0 | 23 | 12 |
| 483 | 1 | 11 | 10 | 648 | 0 | 53 | 3 | 924 | 0 | 37 | 12 | 1206 | 0 | 28 | 31 | 1488 | 0 | 23 | 6 |
| 486 | 1 | 10 | 44 | 654 | 0 | 52 | 34 | 930 | 0 | 36 | 58 | 1212 | 0 | 28 | 22 | 1494 | 0 | 23 | 0 |
| 489 | 1 | 10 | 18 | 660 | 0 | 52 | 5 | 936 | 0 | 36 | 43 | 1218 | 0 | 28 | 13 | 1500 | 0 | 22 | 55 |
| 492 | 1 | 9 | 52 | | | | | | | | | | | | | | | | |

## TABLE XXIV.

### Useful Constants and Numbers.

Ratio of circumference to diameter of a circle $= \pi = 3\cdot141592653590$.
Log $\pi = 0\cdot497149872694$.

$\pi^2 = 9\cdot869604401089$ $\sqrt{\pi} = 1\cdot772453850906$.

Arc of same length as radius $= 180^\circ \div \pi = 10800' \div \pi = 648000'' \div \pi$.

$180^\circ \div \pi = 57^\circ\cdot2957795130$ log $= 1\cdot758122632409$.

$10800' \div \pi = 3437'\cdot7467707849$ log $= 3\cdot536273882793$.

$648000'' \div \pi = 206264''\cdot8062470964$ log $= 5\cdot314425133176$.

Tropical year = 365d. 5h. 48m. 47s.·588 = 365d.·242217456 log = 2·5625810.

Sidereal year = 365d. 6h. 9m. 10s.·742 = 365d.·256374332 log = 2·5625978.

24h. sol. t. = 24h. 3m. 56s.·555335 sid. t. = 24h. × 1·00273791 log 1·002 = 0·0011874.

24h. sid. t. = 24h. − (3m. 55s.·90944) sol. t. = 24h. × 0·9972696 log 0·997 = 9·9988126.

British Imperial gallon = 277·274 cubic inches log = 2·4429091.

10 lbs. of distilled water at 62° F. = 1 gallon.

Length of sec. pend. in inches, at London, 39·13929; Paris, 39·1285; New York, 39·1285.

French mètre = 3·2808992 English feet = 39·3707904 inches.

1 cubic inch of water (bar. 30 inches. Fahr. therm. 62°) = 252·458 Troy grains.

Radius reduced to seconds = 206264·8 log 5·3144251.

,, ,, minutes = 3437·74677 log 3·5362739.

,, ,, degrees = 57·295780 log 1·7581226.

No. of Sexagesimal degrees in a Centesimal degree = 0·9 log $\bar{1}\cdot9542425$.

No. of Sexagesimal minutes in a Centesimal minute = 0·54 log $\bar{1}\cdot7323938$.

No. of Sexagesimal seconds in a Centesimal second = 0·324 log $\bar{1}\cdot5105450$.

No. of feet in a statute mile = 5280 log 3·7226339.

No. of feet in a geographical mile = 6075·6 log 3·7835892.

German square miles × by 21·9 = English square miles.

English square miles ÷ by 21·9 = German square miles.

Russian square verst ÷ by 2·2 = English square miles.

English square miles × by 2·2 = Russian square versts.*

The square of the distance in statute miles − $\frac{4}{7}$ of it = correction for curvature and refraction, in feet.

Diurnal acceleration of stars (= 3m. 55s.·9093) expressed in mean solar seconds = 235·9093 log 2·3727441.

Sidereal day (= 23h. 56m. 4s.·09) expressed in mean solar days = 0·99726967 log $\bar{1}\cdot9988127$.

Mean solar day (= 24h. 3m. 56s.·5554) expressed in sidereal days = 1·00273791 log 0·0011874.

No. of French mètres in a toise = 1·949040 log 0·2898127.

No. of English yards in a French toise = 2·1315308 log 0·3286916.

No. of English feet in a French toise = 6·3945925 log 0·8058128.

1 Gunter's chain = 66 feet.

80 Gunter's chains = 1 statute mile.

Links × 22 = yards.

Links × 66 = feet.

*To find the solidity of a cylinder*, multiply the square of the diameter of its base by 0·7854, and the product multiplied by the perpendicular height of the cylinder will be its solidity.

* For the conversion of various foreign measures into English equivalents, see explanation of Table XXI.

## Tables for Converting Metrical Weights and Measures.

| Hectare. | | Acre. | Kilomètre. | | Eng. Mile. | Square. Kilomètre. | | Square. Eng. Mile. |
|---|---|---|---|---|---|---|---|---|
| 0·405 | **1** | 2·471 | 1·609 | **1** | 0·621 | 2·592 | **1** | 0·386 |
| 0·809 | **2** | 4·942 | 3·219 | **2** | 1·243 | 5·184 | **2** | 0·772 |
| 1·214 | **3** | 7·413 | 4·828 | **3** | 1·864 | 7·776 | **3** | 1·158 |
| 1·619 | **4** | 9·885 | 6·438 | **4** | 2·486 | 10·368 | **4** | 1·544 |
| 2·023 | **5** | 12·356 | 8·047 | **5** | 3·107 | 12·960 | **5** | 1·930 |
| 2·428 | **6** | 14·827 | 9·656 | **6** | 3·728 | 15·552 | **6** | 2·316 |
| 2·833 | **7** | 17·298 | 11·265 | **7** | 4·350 | 18·144 | **7** | 2·702 |
| 3·237 | **8** | 19·769 | 12·879 | **8** | 4·971 | 20·736 | **8** | 3·088 |
| 3·642 | **9** | 22·240 | 14·484 | **9** | 5·592 | 23·328 | **9** | 3·474 |
| 4·047 | **10** | 24·711 | 16·093 | **10** | 6·214 | 25·920 | **10** | 3·860 |
| 8·093 | **20** | 49·423 | 32·186 | **20** | 12·428 | 51·840 | **20** | 7·720 |
| 12·140 | **30** | 74·134 | 48·279 | **30** | 18·641 | 77·760 | **30** | 11·580 |
| 16·187 | **40** | 98·846 | 64·373 | **40** | 24·855 | 103·680 | **40** | 15·440 |
| 20·234 | **50** | 123·557 | 80·466 | **50** | 31·069 | 129·600 | **50** | 19·300 |
| 24·286 | **60** | 148·268 | 96·559 | **60** | 37·283 | 155·520 | **60** | 23·160 |
| 28·327 | **70** | 172·980 | 112·652 | **70** | 43·497 | 181·440 | **70** | 27·020 |
| 32·373 | **80** | 197·692 | 128·746 | **80** | 49·710 | 207·360 | **80** | 30·880 |
| 36·420 | **90** | 222·903 | 144·839 | **90** | 55·924 | 233·280 | **90** | 34·740 |
| 40·467 | **100** | 247·114 | 160·932 | **100** | 62·138 | 259·200 | **100** | 38·601 |

| Mètre. | | Yard. | Kilogramme. | | Lb. Avoir. | Litre. | | Gallons. |
|---|---|---|---|---|---|---|---|---|
| 0·914 | **1** | 1·094 | 0·454 | **1** | 2·20 | 4·54 | **1** | 0·22 |
| 1·829 | **2** | 2·187 | 0·907 | **2** | 4·41 | 9·09 | **2** | 0·44 |
| 2·743 | **3** | 3·281 | 1·361 | **3** | 6·61 | 13·63 | **3** | 0·66 |
| 3·658 | **4** | 4·374 | 1·814 | **4** | 8·82 | 18·17 | **4** | 0·88 |
| 4·572 | **5** | 5·468 | 2·268 | **5** | 11·02 | 22·72 | **5** | 1·10 |
| 5·485 | **6** | 6·562 | 2·722 | **6** | 13·23 | 27·26 | **6** | 1·32 |
| 6·401 | **7** | 7·655 | 3·175 | **7** | 15·43 | 31·80 | **7** | 1·54 |
| 7·315 | **8** | 8·749 | 3·629 | **8** | 17·64 | 36·35 | **8** | 1·76 |
| 8·229 | **9** | 9·843 | 4·082 | **9** | 19·84 | 40·89 | **9** | 1·98 |
| 9·144 | **10** | 10·936 | 4·536 | **10** | 22·05 | 45·43 | **10** | 2·20 |
| 18·288 | **20** | 21·873 | 9·072 | **20** | 44·09 | 90·87 | **20** | 4·40 |
| 27·432 | **30** | 32·809 | 13·608 | **30** | 66·14 | 136·30 | **30** | 6·60 |
| 36·576 | **40** | 43·745 | 18·144 | **40** | 88·18 | 181·74 | **40** | 8·80 |
| 45·719 | **50** | 54·682 | 22·679 | **50** | 110·23 | 227·17 | **50** | 11·00 |
| 54·863 | **60** | 65·618 | 27·215 | **60** | 132·28 | 272·61 | **60** | 13·20 |
| 64·007 | **70** | 76·554 | 31·752 | **70** | 154·32 | 318·04 | **70** | 15·40 |
| 73·151 | **80** | 87·491 | 36·288 | **80** | 176·37 | 363·48 | **80** | 17·60 |
| 82·295 | **90** | 98·427 | 40·823 | **90** | 198·42 | 408·91 | **90** | 19·80 |
| 91·438 | **100** | 109·363 | 45·359 | **100** | 220·46 | 454·35 | **100** | 22·01 |

*For the use of these tables the following explanation is necessary:—The figures in heavier type represent either of the columns beside it, as the case may be; viz., with hectares and acres in the first set of columns,* 1 *acre* = 0·405 *hectare, and vice versâ,* 1 *hectare* = 2·471 *acres, and so on.*

## TABLE XXV.

### LOGARITHMS OF NUMBERS

No. 1 to 100 — Log. 0·000000 to 2·000000

| No. | Log. | No. | Log. | No. | Log. | No. | Log. | No. | Log. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0·000000 | 21 | 1·322219 | 41 | 1·612784 | 61 | 1·785330 | 81 | 1·908485 |
| 2 | 0·301030 | 22 | 1·342423 | 42 | 1·623249 | 62 | 1·792392 | 82 | 1·913814 |
| 3 | 0·477121 | 23 | 1·361728 | 43 | 1·633468 | 63 | 1·799341 | 83 | 1·919078 |
| 4 | 0·602060 | 24 | 1·380211 | 44 | 1·643453 | 64 | 1·806180 | 84 | 1·924279 |
| 5 | 0·698970 | 25 | 1·397940 | 45 | 1·653213 | 65 | 1·812913 | 85 | 1·929419 |
| 6 | 0·778151 | 26 | 1·414973 | 46 | 1·662758 | 66 | 1·819544 | 86 | 1·934498 |
| 7 | 0·845098 | 27 | 1·431364 | 47 | 1·672098 | 67 | 1·826075 | 87 | 1·939519 |
| 8 | 0·903090 | 28 | 1·447158 | 48 | 1·681241 | 68 | 1·832509 | 88 | 1·944483 |
| 9 | 0·954243 | 29 | 1·462398 | 49 | 1·690196 | 69 | 1·838849 | 89 | 1·949390 |
| 10 | 1·000000 | 30 | 1·477121 | 50 | 1·698970 | 70 | 1·845098 | 90 | 1·954243 |
| 11 | 1·041393 | 31 | 1·491362 | 51 | 1·707570 | 71 | 1·851258 | 91 | 1·959041 |
| 12 | 1·079181 | 32 | 1·505150 | 52 | 1·716003 | 72 | 1·857332 | 92 | 1·963788 |
| 13 | 1·113943 | 33 | 1·518514 | 53 | 1·724276 | 73 | 1·863323 | 93 | 1·968483 |
| 14 | 1·146128 | 34 | 1·531479 | 54 | 1·732394 | 74 | 1·869232 | 94 | 1·973128 |
| 15 | 1·176091 | 35 | 1·544068 | 55 | 1·740363 | 75 | 1·875061 | 95 | 1·977724 |
| 16 | 1·204120 | 36 | 1·556303 | 56 | 1·748188 | 76 | 1·880814 | 96 | 1·982271 |
| 17 | 1·230449 | 37 | 1·568202 | 57 | 1·755875 | 77 | 1·886491 | 97 | 1·986772 |
| 18 | 1·255273 | 38 | 1·579784 | 58 | 1·763428 | 78 | 1·892095 | 98 | 1·991226 |
| 19 | 1·278754 | 39 | 1·591065 | 59 | 1·770852 | 79 | 1·897627 | 99 | 1·995635 |
| 20 | 1·301030 | 40 | 1·602060 | 60 | 1·778151 | 80 | 1·903090 | 100 | 2·000000 |

No. 1000 to 1149 — Log. 0 to 060320

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 000000 | 000434 | 000868 | 001301 | 001734 | 002166 | 002598 | 003029 | 003461 | 003891 | 432 |
| 101 | 004321 | 004751 | 005181 | 005609 | 006038 | 006466 | 006894 | 007321 | 007748 | 008174 | 428 |
| 102 | 008600 | 009026 | 009451 | 009876 | 010300 | 010724 | 011147 | 011570 | 011993 | 012415 | 424 |
| 103 | 012837 | 013259 | 013680 | 014100 | 014521 | 014940 | 015360 | 015779 | 016197 | 016616 | 420 |
| 104 | 017033 | 017451 | 017868 | 018284 | 018700 | 019116 | 019532 | 019947 | 020361 | 020775 | 416 |
| 105 | 021189 | 021603 | 022016 | 022428 | 022841 | 023252 | 023664 | 024075 | 024486 | 024896 | 412 |
| 106 | 025306 | 025715 | 026125 | 026533 | 026942 | 027350 | 027757 | 028164 | 028571 | 028978 | 408 |
| 107 | 029384 | 029789 | 030195 | 030600 | 031004 | 031408 | 031812 | 032216 | 032619 | 033021 | 404 |
| 108 | 033424 | 033826 | 034227 | 034628 | 035029 | 035430 | 035830 | 036230 | 036629 | 037028 | 400 |
| 109 | 037426 | 037825 | 038223 | 038620 | 039017 | 039414 | 039811 | 040207 | 040602 | 040998 | 397 |
| 110 | 041393 | 041787 | 042182 | 042576 | 042969 | 043362 | 043755 | 044148 | 044540 | 044932 | 393 |
| 111 | 045323 | 045714 | 046105 | 046495 | 046885 | 047275 | 047664 | 048053 | 048442 | 048830 | 389 |
| 112 | 049218 | 049606 | 049993 | 050380 | 050766 | 051153 | 051538 | 051924 | 052309 | 052694 | 386 |
| 113 | 053078 | 053463 | 053846 | 054230 | 054613 | 054996 | 055378 | 055760 | 056142 | 056524 | 383 |
| 114 | 056905 | 057286 | 057666 | 058046 | 058426 | 058805 | 059185 | 059563 | 059942 | 060320 | 379 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 378 | 38 | 76 | 113 | 151 | 189 | 227 | 265 | 302 | 340 | 408 | 41 | 82 | 122 | 163 | 204 | 245 | 286 | 326 | 367 |
| 380 | 38 | 76 | 114 | 152 | 190 | 228 | 266 | 304 | 342 | 410 | 41 | 82 | 123 | 164 | 205 | 246 | 287 | 328 | 369 |
| 382 | 38 | 76 | 115 | 153 | 191 | 229 | 267 | 306 | 344 | 412 | 41 | 82 | 124 | 165 | 206 | 247 | 288 | 330 | 371 |
| 384 | 38 | 77 | 115 | 154 | 192 | 230 | 269 | 307 | 346 | 414 | 41 | 83 | 124 | 166 | 207 | 248 | 290 | 331 | 373 |
| 386 | 39 | 77 | 116 | 154 | 193 | 232 | 270 | 309 | 347 | 416 | 42 | 83 | 125 | 166 | 208 | 250 | 291 | 333 | 374 |
| 388 | 39 | 78 | 116 | 155 | 194 | 233 | 272 | 310 | 349 | 418 | 42 | 84 | 125 | 167 | 209 | 251 | 293 | 334 | 376 |
| 390 | 39 | 78 | 117 | 156 | 195 | 234 | 273 | 312 | 351 | 420 | 42 | 84 | 126 | 168 | 210 | 252 | 294 | 336 | 378 |
| 392 | 39 | 78 | 118 | 157 | 196 | 235 | 274 | 314 | 353 | 422 | 42 | 84 | 127 | 169 | 211 | 253 | 295 | 338 | 380 |
| 394 | 39 | 79 | 118 | 158 | 197 | 236 | 276 | 315 | 355 | 424 | 42 | 85 | 127 | 170 | 212 | 254 | 297 | 339 | 382 |
| 396 | 40 | 79 | 119 | 158 | 198 | 238 | 277 | 317 | 356 | 426 | 43 | 85 | 128 | 170 | 213 | 256 | 298 | 341 | 383 |
| 398 | 40 | 80 | 119 | 159 | 199 | 239 | 279 | 318 | 358 | 428 | 43 | 86 | 128 | 171 | 214 | 257 | 300 | 342 | 385 |
| 400 | 40 | 80 | 120 | 160 | 200 | 240 | 280 | 320 | 360 | 430 | 43 | 86 | 129 | 172 | 215 | 258 | 301 | 344 | 387 |
| 402 | 40 | 80 | 121 | 161 | 201 | 241 | 281 | 322 | 362 | 432 | 43 | 86 | 130 | 173 | 216 | 259 | 302 | 346 | 389 |
| 404 | 40 | 81 | 121 | 162 | 202 | 242 | 283 | 323 | 364 | 434 | 43 | 87 | 130 | 174 | 217 | 260 | 304 | 347 | 391 |
| 406 | 41 | 81 | 122 | 162 | 203 | 244 | 284 | 325 | 365 | | | | | | | | | | |

## TABLE XXV.—(*continued*).

### LOGARITHMS OF NUMBERS

No. 1150 to 1499 — Log. 060698 to 175802

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 060698 | 061075 | 061452 | 061829 | 062206 | 062582 | 062958 | 063333 | 063709 | 064083 | 376 |
| 116 | 064458 | 064832 | 065206 | 065580 | 065953 | 066326 | 066699 | 067071 | 067443 | 067815 | 373 |
| 117 | 068186 | 068557 | 068927 | 069298 | 069668 | 070038 | 070407 | 070776 | 071145 | 071514 | 370 |
| 118 | 071882 | 072250 | 072617 | 072985 | 073352 | 073718 | 074085 | 074451 | 074816 | 075182 | 366 |
| 119 | 075547 | 075912 | 076276 | 076640 | 077004 | 077368 | 077731 | 078094 | 078457 | 078819 | 363 |
| 120 | 079181 | 079543 | 079904 | 080266 | 080626 | 080987 | 081347 | 081707 | 082067 | 082426 | 360 |
| 121 | 082785 | 083144 | 083503 | 083861 | 084219 | 084576 | 084934 | 085291 | 085647 | 086004 | 357 |
| 122 | 086360 | 086716 | 087071 | 087426 | 087781 | 088136 | 088490 | 088845 | 089198 | 089552 | 355 |
| 123 | 089905 | 090258 | 090611 | 090963 | 091315 | 091667 | 092018 | 092370 | 092721 | 093071 | 352 |
| 124 | 093422 | 093772 | 094122 | 094471 | 094820 | 095169 | 095518 | 095866 | 096215 | 096562 | 349 |
| 125 | 096910 | 097257 | 097604 | 097951 | 098298 | 098644 | 098990 | 099335 | 099681 | 100026 | 346 |
| 126 | 100371 | 100715 | 101059 | 101403 | 101747 | 102091 | 102434 | 102777 | 103119 | 103462 | 343 |
| 127 | 103804 | 104146 | 104487 | 104828 | 105169 | 105510 | 105851 | 106191 | 106531 | 106871 | 341 |
| 128 | 107210 | 107549 | 107888 | 108227 | 108565 | 108903 | 109241 | 109579 | 109916 | 110253 | 338 |
| 129 | 110590 | 110926 | 111263 | 111599 | 111934 | 112270 | 112605 | 112940 | 113275 | 113609 | 335 |
| 130 | 113943 | 114277 | 114611 | 114944 | 115278 | 115611 | 115943 | 116276 | 116608 | 116940 | 333 |
| 131 | 117271 | 117603 | 117934 | 118265 | 118595 | 118926 | 119256 | 119586 | 119915 | 120245 | 330 |
| 132 | 120574 | 120903 | 121231 | 121560 | 121888 | 122216 | 122544 | 122871 | 123198 | 123525 | 328 |
| 133 | 123852 | 124178 | 124504 | 124830 | 125156 | 125481 | 125806 | 126131 | 126456 | 126781 | 325 |
| 134 | 127105 | 127429 | 127753 | 128076 | 128399 | 128722 | 129045 | 129368 | 129690 | 130012 | 323 |
| 135 | 130334 | 130655 | 130977 | 131298 | 131619 | 131939 | 132260 | 132580 | 132900 | 133219 | 321 |
| 136 | 133539 | 133858 | 134177 | 134496 | 134814 | 135133 | 135451 | 135769 | 136086 | 136403 | 318 |
| 137 | 136721 | 137037 | 137354 | 137671 | 137987 | 138303 | 138618 | 138934 | 139249 | 139564 | 316 |
| 138 | 139879 | 140194 | 140508 | 140822 | 141136 | 141450 | 141763 | 142076 | 142389 | 142702 | 314 |
| 139 | 143015 | 143327 | 143639 | 143951 | 144263 | 144574 | 144885 | 145196 | 145507 | 145818 | 311 |
| 140 | 146128 | 146438 | 146748 | 147058 | 147367 | 147676 | 147985 | 148294 | 148603 | 148911 | 309 |
| 141 | 149219 | 149527 | 149835 | 150142 | 150449 | 150756 | 151063 | 151370 | 151676 | 151982 | 307 |
| 142 | 152288 | 152594 | 152900 | 153205 | 153510 | 153815 | 154120 | 154424 | 154728 | 155032 | 305 |
| 143 | 155336 | 155640 | 155943 | 156246 | 156549 | 156852 | 157154 | 157457 | 157759 | 158061 | 303 |
| 144 | 158362 | 158664 | 158965 | 159266 | 159567 | 159868 | 160168 | 160469 | 160769 | 161068 | 301 |
| 145 | 161368 | 161667 | 161967 | 162266 | 162564 | 162863 | 163161 | 163460 | 163758 | 164055 | 299 |
| 146 | 164353 | 164650 | 164947 | 165244 | 165541 | 165838 | 166134 | 166430 | 166726 | 167022 | 297 |
| 147 | 167317 | 167613 | 167908 | 168203 | 168497 | 168792 | 169086 | 169380 | 169674 | 169968 | 295 |
| 148 | 170262 | 170555 | 170848 | 171141 | 171434 | 171726 | 172019 | 172311 | 172603 | 172895 | 293 |
| 149 | 173186 | 173478 | 173769 | 174060 | 174351 | 174641 | 174932 | 175222 | 175512 | 175802 | 291 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 290 | 29 | 58 | 87 | 116 | 145 | 174 | 203 | 232 | 261 | 334 | 33 | 67 | 100 | 134 | 167 | 200 | 234 | 267 | 301 |
| 292 | 29 | 58 | 88 | 117 | 146 | 175 | 204 | 234 | 263 | 336 | 34 | 67 | 101 | 134 | 168 | 202 | 235 | 269 | 302 |
| 294 | 29 | 59 | 88 | 118 | 147 | 176 | 206 | 235 | 265 | 338 | 34 | 68 | 101 | 135 | 169 | 203 | 237 | 270 | 304 |
| 296 | 30 | 59 | 89 | 118 | 148 | 178 | 207 | 237 | 266 | 340 | 34 | 68 | 102 | 136 | 170 | 204 | 238 | 272 | 306 |
| 298 | 30 | 60 | 89 | 119 | 149 | 179 | 209 | 238 | 268 | 342 | 34 | 68 | 103 | 137 | 171 | 205 | 239 | 274 | 308 |
| 300 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 344 | 34 | 69 | 103 | 138 | 172 | 206 | 241 | 275 | 310 |
| 302 | 30 | 60 | 91 | 121 | 151 | 181 | 211 | 242 | 272 | 346 | 35 | 69 | 104 | 138 | 173 | 208 | 242 | 277 | 311 |
| 304 | 30 | 61 | 91 | 122 | 152 | 182 | 213 | 243 | 274 | 348 | 35 | 70 | 104 | 139 | 174 | 209 | 244 | 278 | 313 |
| 306 | 31 | 61 | 92 | 122 | 153 | 184 | 214 | 245 | 275 | 350 | 35 | 70 | 105 | 140 | 175 | 210 | 245 | 280 | 315 |
| 308 | 31 | 62 | 92 | 123 | 154 | 185 | 216 | 246 | 277 | 352 | 35 | 70 | 106 | 141 | 176 | 211 | 246 | 282 | 317 |
| 310 | 31 | 62 | 93 | 124 | 155 | 186 | 217 | 248 | 279 | 354 | 35 | 71 | 106 | 142 | 177 | 212 | 248 | 283 | 319 |
| 312 | 31 | 62 | 94 | 125 | 156 | 187 | 218 | 250 | 281 | 356 | 36 | 71 | 107 | 142 | 178 | 214 | 249 | 285 | 320 |
| 314 | 31 | 63 | 94 | 126 | 157 | 188 | 220 | 251 | 283 | 358 | 36 | 72 | 107 | 143 | 179 | 215 | 251 | 286 | 322 |
| 316 | 32 | 63 | 95 | 126 | 158 | 190 | 221 | 253 | 284 | 360 | 36 | 72 | 108 | 144 | 180 | 216 | 252 | 288 | 324 |
| 318 | 32 | 64 | 95 | 127 | 159 | 191 | 223 | 254 | 286 | 362 | 36 | 72 | 109 | 145 | 181 | 217 | 253 | 290 | 326 |
| 320 | 32 | 64 | 96 | 128 | 160 | 192 | 224 | 256 | 288 | 364 | 36 | 73 | 109 | 146 | 182 | 218 | 255 | 291 | 328 |
| 322 | 32 | 64 | 97 | 129 | 161 | 193 | 225 | 258 | 290 | 366 | 37 | 73 | 110 | 146 | 183 | 220 | 256 | 293 | 329 |
| 324 | 32 | 65 | 97 | 130 | 162 | 194 | 227 | 259 | 292 | 368 | 37 | 74 | 110 | 147 | 184 | 221 | 258 | 294 | 331 |
| 326 | 33 | 65 | 98 | 130 | 163 | 196 | 228 | 261 | 293 | 370 | 37 | 74 | 111 | 148 | 185 | 222 | 259 | 296 | 333 |
| 328 | 33 | 66 | 98 | 131 | 164 | 197 | 230 | 262 | 295 | 372 | 37 | 74 | 112 | 149 | 186 | 223 | 260 | 298 | 335 |
| 330 | 33 | 66 | 99 | 132 | 165 | 198 | 231 | 264 | 297 | 374 | 37 | 75 | 112 | 150 | 187 | 224 | 262 | 299 | 337 |
| 332 | 33 | 66 | 100 | 133 | 166 | 199 | 232 | 266 | 299 | 376 | 38 | 75 | 113 | 150 | 188 | 226 | 263 | 301 | 338 |

## TABLE XXV.—(*continued*).

### LOGARITHMS OF NUMBERS

**No. 1500 to 1899** | **Log. 176091 to 278525**

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 150 | 176091 | 176381 | 176670 | 176959 | 177248 | 177536 | 177825 | 178113 | 178401 | 178689 | 289 |
| 151 | 178977 | 179264 | 179552 | 179839 | 180126 | 180413 | 180699 | 180986 | 181272 | 181558 | 287 |
| 152 | 181844 | 182129 | 182415 | 182700 | 182985 | 183270 | 183555 | 183839 | 184123 | 184407 | 285 |
| 153 | 184691 | 184975 | 185259 | 185542 | 185825 | 186108 | 186391 | 186674 | 186956 | 187239 | 283 |
| 154 | 187521 | 187803 | 188084 | 188366 | 188647 | 188928 | 189209 | 189490 | 189771 | 190051 | 281 |
| 155 | 190332 | 190612 | 190892 | 191171 | 191451 | 191730 | 192010 | 192289 | 192567 | 192846 | 279 |
| 156 | 193125 | 193403 | 193681 | 193959 | 194237 | 194514 | 194792 | 195069 | 195346 | 195623 | 278 |
| 157 | 195900 | 196176 | 196453 | 196729 | 197005 | 197281 | 197556 | 197832 | 198107 | 198382 | 276 |
| 158 | 198657 | 198932 | 199206 | 199481 | 199755 | 200029 | 200303 | 200577 | 200850 | 201124 | 274 |
| 159 | 201397 | 201670 | 201943 | 202216 | 202488 | 202761 | 203033 | 203305 | 203577 | 203848 | 272 |
| 160 | 204120 | 204391 | 204663 | 204934 | 205204 | 205475 | 205746 | 206016 | 206286 | 206556 | 271 |
| 161 | 206826 | 207096 | 207365 | 207634 | 207904 | 208173 | 208441 | 208710 | 208979 | 209247 | 269 |
| 162 | 209515 | 209783 | 210051 | 210319 | 210586 | 210853 | 211121 | 211388 | 211654 | 211921 | 267 |
| 163 | 212188 | 212454 | 212720 | 212986 | 213252 | 213518 | 213783 | 214049 | 214314 | 214579 | 266 |
| 164 | 214844 | 215109 | 215373 | 215638 | 215902 | 216166 | 216430 | 216694 | 216957 | 217221 | 264 |
| 165 | 217484 | 217747 | 218010 | 218273 | 218536 | 218798 | 219060 | 219323 | 219585 | 219846 | 262 |
| 166 | 220108 | 220370 | 220631 | 220892 | 221153 | 221414 | 221675 | 221936 | 222196 | 222456 | 261 |
| 167 | 222716 | 222976 | 223236 | 223496 | 223755 | 224015 | 224274 | 224533 | 224792 | 225051 | 259 |
| 168 | 225309 | 225568 | 225826 | 226084 | 226342 | 226600 | 226858 | 227115 | 227372 | 227630 | 258 |
| 169 | 227887 | 228144 | 228400 | 228657 | 228913 | 229170 | 229426 | 229682 | 229938 | 230193 | 256 |
| 170 | 230449 | 230704 | 230960 | 231215 | 231470 | 231724 | 231979 | 232234 | 232488 | 232742 | 255 |
| 171 | 232996 | 233250 | 233504 | 233757 | 234011 | 234264 | 234517 | 234770 | 235023 | 235276 | 253 |
| 172 | 235528 | 235781 | 236033 | 236285 | 236537 | 236789 | 237041 | 237292 | 237544 | 237795 | 252 |
| 173 | 238046 | 238297 | 238548 | 238799 | 239049 | 239299 | 239550 | 239800 | 240050 | 240300 | 250 |
| 174 | 240549 | 240799 | 241048 | 241297 | 241546 | 241795 | 242044 | 242293 | 242541 | 242790 | 249 |
| 175 | 243038 | 243286 | 243534 | 243782 | 244030 | 244277 | 244525 | 244772 | 245019 | 245266 | 248 |
| 176 | 245513 | 245759 | 246006 | 246252 | 246499 | 246745 | 246991 | 247237 | 247482 | 247728 | 246 |
| 177 | 247973 | 248219 | 248464 | 248709 | 248954 | 249198 | 249443 | 249687 | 249932 | 250176 | 245 |
| 178 | 250420 | 250664 | 250908 | 251151 | 251395 | 251638 | 251881 | 252125 | 252368 | 252610 | 243 |
| 179 | 252853 | 253096 | 253338 | 253580 | 253822 | 254064 | 254306 | 254548 | 254790 | 255031 | 242 |
| 180 | 255273 | 255514 | 255755 | 255996 | 256237 | 256477 | 256718 | 256958 | 257198 | 257439 | 241 |
| 181 | 257679 | 257918 | 258158 | 258398 | 258637 | 258877 | 259116 | 259355 | 259594 | 259833 | 239 |
| 182 | 260071 | 260310 | 260548 | 260787 | 261025 | 261263 | 261501 | 261739 | 261976 | 262214 | 238 |
| 183 | 262451 | 262688 | 262925 | 263162 | 263399 | 263636 | 263873 | 264109 | 264346 | 264582 | 237 |
| 184 | 264818 | 265054 | 265290 | 265525 | 265761 | 265996 | 266232 | 266467 | 266702 | 266937 | 235 |
| 185 | 267172 | 267406 | 267641 | 267875 | 268110 | 268344 | 268578 | 268812 | 269046 | 269279 | 234 |
| 186 | 269513 | 269746 | 269980 | 270213 | 270446 | 270679 | 270912 | 271144 | 271377 | 271609 | 233 |
| 187 | 271842 | 272074 | 272306 | 272538 | 272770 | 273001 | 273233 | 273464 | 273696 | 273927 | 232 |
| 188 | 274158 | 274389 | 274620 | 274850 | 275081 | 275311 | 275542 | 275772 | 276002 | 276232 | 230 |
| 189 | 276462 | 276692 | 276921 | 277151 | 277380 | 277609 | 277838 | 278067 | 278296 | 278525 | 229 |
| No | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 228 | 23 | 46 | 68 | 91 | 114 | 137 | 160 | 182 | 205 | 260 | 26 | 52 | 78 | 104 | 130 | 156 | 182 | 208 | 234 |
| 230 | 23 | 46 | 69 | 92 | 115 | 138 | 161 | 184 | 207 | 262 | 26 | 52 | 79 | 105 | 131 | 157 | 183 | 210 | 236 |
| 232 | 23 | 46 | 70 | 93 | 116 | 139 | 162 | 186 | 209 | 264 | 26 | 53 | 79 | 106 | 132 | 158 | 185 | 211 | 238 |
| 234 | 23 | 47 | 70 | 94 | 117 | 140 | 164 | 187 | 211 | 266 | 27 | 53 | 80 | 106 | 133 | 160 | 186 | 213 | 239 |
| 236 | 24 | 47 | 71 | 94 | 118 | 142 | 165 | 189 | 212 | 268 | 27 | 54 | 80 | 107 | 134 | 161 | 188 | 214 | 241 |
| 238 | 24 | 48 | 71 | 95 | 119 | 143 | 167 | 190 | 214 | 270 | 27 | 54 | 81 | 108 | 135 | 162 | 189 | 216 | 243 |
| 240 | 24 | 48 | 72 | 96 | 120 | 144 | 168 | 192 | 216 | 272 | 27 | 54 | 82 | 109 | 136 | 163 | 190 | 218 | 245 |
| 242 | 24 | 48 | 73 | 97 | 121 | 145 | 169 | 194 | 218 | 274 | 27 | 55 | 82 | 110 | 137 | 164 | 192 | 219 | 247 |
| 244 | 24 | 49 | 73 | 98 | 122 | 146 | 171 | 195 | 220 | 276 | 28 | 55 | 83 | 110 | 138 | 166 | 193 | 221 | 248 |
| 246 | 25 | 49 | 74 | 98 | 123 | 148 | 172 | 197 | 221 | 278 | 28 | 56 | 83 | 111 | 139 | 167 | 195 | 222 | 250 |
| 248 | 25 | 50 | 74 | 99 | 124 | 149 | 174 | 198 | 223 | 280 | 28 | 56 | 84 | 112 | 140 | 168 | 196 | 224 | 252 |
| 250 | 25 | 50 | 75 | 100 | 125 | 150 | 175 | 200 | 225 | 282 | 28 | 56 | 85 | 113 | 141 | 169 | 197 | 226 | 254 |
| 252 | 25 | 50 | 76 | 101 | 126 | 151 | 176 | 202 | 227 | 284 | 28 | 57 | 85 | 114 | 142 | 170 | 199 | 227 | 256 |
| 254 | 25 | 51 | 76 | 102 | 127 | 152 | 178 | 203 | 229 | 286 | 29 | 57 | 86 | 114 | 143 | 172 | 200 | 229 | 257 |
| 256 | 26 | 51 | 77 | 102 | 128 | 154 | 179 | 205 | 230 | 288 | 29 | 58 | 86 | 115 | 144 | 173 | 202 | 230 | 259 |
| 258 | 26 | 52 | 77 | 103 | 129 | 155 | 181 | 206 | 232 | 290 | 29 | 58 | 87 | 116 | 145 | 174 | 203 | 232 | 261 |

TABLE XXV.—(*continued*).

## LOGARITHMS OF NUMBERS.

No. 1900 to 2349 — Log. 278754 to 370883

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 190 | 278754 | 278982 | 279211 | 279439 | 279667 | 279895 | 280123 | 280351 | 280578 | 280806 | 228 |
| 191 | 281033 | 281261 | 281488 | 281715 | 281942 | 282169 | 282396 | 282622 | 282849 | 283075 | 227 |
| 192 | 283301 | 283527 | 283753 | 283979 | 284205 | 284431 | 284656 | 284882 | 285107 | 285332 | 226 |
| 193 | 285557 | 285782 | 286007 | 286232 | 286456 | 286681 | 286905 | 287130 | 287354 | 287578 | 225 |
| 194 | 287802 | 288026 | 288249 | 288473 | 288696 | 288920 | 289143 | 289366 | 289589 | 289812 | 223 |
| 195 | 290035 | 290257 | 290480 | 290702 | 290925 | 291147 | 291369 | 291591 | 291813 | 292034 | 222 |
| 196 | 292256 | 292478 | 292699 | 292920 | 293141 | 293363 | 293584 | 293804 | 294025 | 294246 | 221 |
| 197 | 294466 | 294687 | 294907 | 295127 | 295347 | 295567 | 295787 | 296007 | 296226 | 296446 | 220 |
| 198 | 296665 | 296884 | 297104 | 297323 | 297542 | 297761 | 297979 | 298198 | 298416 | 298635 | 219 |
| 199 | 298853 | 299071 | 299289 | 299507 | 299725 | 299943 | 300161 | 300378 | 300595 | 300813 | 218 |
| 200 | 301030 | 301247 | 301464 | 301681 | 301898 | 302114 | 302331 | 302547 | 302764 | 302980 | 217 |
| 201 | 303196 | 303412 | 303628 | 303844 | 304059 | 304275 | 304491 | 304706 | 304921 | 305136 | 216 |
| 202 | 305351 | 305566 | 305781 | 305996 | 306211 | 306425 | 306639 | 306854 | 307068 | 307282 | 215 |
| 203 | 307496 | 307710 | 307924 | 308137 | 308351 | 308564 | 308778 | 308991 | 309204 | 309417 | 213 |
| 204 | 309630 | 309843 | 310056 | 310268 | 310481 | 310693 | 310906 | 311118 | 311330 | 311542 | 212 |
| 205 | 311754 | 311966 | 312177 | 312389 | 312600 | 312812 | 313023 | 313234 | 313445 | 313656 | 211 |
| 206 | 313867 | 314078 | 314289 | 314499 | 314710 | 314920 | 315130 | 315340 | 315551 | 315760 | 210 |
| 207 | 315970 | 316180 | 316390 | 316599 | 316809 | 317018 | 317227 | 317436 | 317646 | 317854 | 209 |
| 208 | 318063 | 318272 | 318481 | 318689 | 318898 | 319106 | 319314 | 319522 | 319730 | 319938 | 208 |
| 209 | 320146 | 320354 | 320562 | 320769 | 320977 | 321184 | 321391 | 321598 | 321805 | 322012 | 207 |
| 210 | 322219 | 322426 | 322633 | 322839 | 323046 | 323252 | 323458 | 323665 | 323871 | 324077 | 206 |
| 211 | 324282 | 324488 | 324694 | 324899 | 325105 | 325310 | 325516 | 325721 | 325926 | 326131 | 205 |
| 212 | 326336 | 326541 | 326745 | 326950 | 327155 | 327359 | 327563 | 327767 | 327972 | 328176 | 204 |
| 213 | 328380 | 328583 | 328787 | 328991 | 329194 | 329398 | 329601 | 329805 | 330008 | 330211 | 203 |
| 214 | 330414 | 330617 | 330819 | 331022 | 331225 | 331427 | 331630 | 331832 | 332034 | 332236 | 202 |
| 215 | 332438 | 332640 | 332842 | 333044 | 333246 | 333447 | 333649 | 333850 | 334051 | 334253 | 202 |
| 216 | 334454 | 334655 | 334856 | 335057 | 335257 | 335458 | 335658 | 335859 | 336059 | 336260 | 201 |
| 217 | 336460 | 336660 | 336860 | 337060 | 337260 | 337459 | 337659 | 337858 | 338058 | 338257 | 200 |
| 218 | 338456 | 338656 | 338855 | 339054 | 339253 | 339451 | 339650 | 339849 | 340047 | 340246 | 199 |
| 219 | 340444 | 340642 | 340841 | 341039 | 341237 | 341435 | 341632 | 341830 | 342028 | 342225 | 198 |
| 220 | 342423 | 342620 | 342817 | 343014 | 343212 | 343409 | 343606 | 343802 | 343999 | 344196 | 197 |
| 221 | 344392 | 344589 | 344785 | 344981 | 345178 | 345374 | 345570 | 345766 | 345962 | 346157 | 196 |
| 222 | 346353 | 346549 | 346744 | 346939 | 347135 | 347330 | 347525 | 347720 | 347915 | 348110 | 195 |
| 223 | 348305 | 348500 | 348694 | 348889 | 349083 | 349278 | 349472 | 349666 | 349860 | 350054 | 194 |
| 224 | 350248 | 350442 | 350636 | 350829 | 351023 | 351216 | 351410 | 351603 | 351796 | 351989 | 193 |
| 225 | 352183 | 352375 | 352568 | 352761 | 352954 | 353147 | 353339 | 353532 | 353724 | 353916 | 193 |
| 226 | 354108 | 354301 | 354493 | 354685 | 354876 | 355068 | 355260 | 355452 | 355643 | 355834 | 192 |
| 227 | 356026 | 356217 | 356408 | 356599 | 356790 | 356981 | 357172 | 357363 | 357554 | 357744 | 191 |
| 228 | 357935 | 358125 | 358316 | 358506 | 358696 | 358886 | 359076 | 359266 | 359456 | 359646 | 190 |
| 229 | 359835 | 360025 | 360215 | 360404 | 360593 | 360783 | 360972 | 361161 | 361350 | 361539 | 189 |
| 230 | 361728 | 361917 | 362105 | 362294 | 362482 | 362671 | 362859 | 363048 | 363236 | 363424 | 188 |
| 231 | 363612 | 363800 | 363988 | 364176 | 364363 | 364551 | 364739 | 364926 | 365113 | 365301 | 188 |
| 232 | 365488 | 365675 | 365862 | 366049 | 366236 | 366423 | 366610 | 366796 | 366983 | 367169 | 187 |
| 233 | 367356 | 367542 | 367729 | 367915 | 368101 | 368287 | 368473 | 368659 | 368845 | 369030 | 186 |
| 234 | 369216 | 369401 | 369587 | 369772 | 369958 | 370143 | 370328 | 370513 | 370698 | 370883 | 185 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 184 | 18 | 37 | 55 | 74 | 92 | 110 | 129 | 147 | 166 | 208 | 21 | 42 | 62 | 83 | 104 | 125 | 146 | 166 | 187 |
| 186 | 19 | 37 | 56 | 74 | 93 | 112 | 130 | 149 | 167 | 210 | 21 | 42 | 63 | 84 | 105 | 126 | 147 | 168 | 189 |
| 188 | 19 | 38 | 56 | 75 | 94 | 113 | 132 | 150 | 169 | 212 | 21 | 42 | 64 | 85 | 106 | 127 | 148 | 170 | 191 |
| 190 | 19 | 38 | 57 | 76 | 95 | 114 | 133 | 152 | 171 | 214 | 21 | 43 | 64 | 86 | 107 | 128 | 150 | 171 | 193 |
| 192 | 19 | 38 | 58 | 77 | 96 | 115 | 134 | 154 | 173 | 216 | 22 | 43 | 65 | 86 | 108 | 130 | 151 | 173 | 194 |
| 194 | 19 | 39 | 58 | 78 | 97 | 116 | 136 | 155 | 175 | 218 | 22 | 44 | 65 | 87 | 109 | 131 | 153 | 174 | 196 |
| 196 | 20 | 39 | 59 | 78 | 98 | 118 | 137 | 157 | 176 | 220 | 22 | 44 | 66 | 88 | 110 | 132 | 154 | 176 | 198 |
| 198 | 20 | 40 | 59 | 79 | 99 | 119 | 139 | 158 | 178 | 222 | 22 | 44 | 67 | 89 | 111 | 133 | 155 | 178 | 200 |
| 200 | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 224 | 22 | 45 | 67 | 90 | 112 | 134 | 157 | 179 | 202 |
| 202 | 20 | 40 | 61 | 81 | 101 | 121 | 141 | 162 | 182 | 226 | 23 | 45 | 68 | 90 | 113 | 136 | 158 | 181 | 203 |
| 204 | 20 | 41 | 61 | 82 | 102 | 122 | 143 | 163 | 184 | 228 | 23 | 46 | 68 | 91 | 114 | 137 | 160 | 182 | 205 |
| 206 | 21 | 41 | 62 | 82 | 103 | 124 | 144 | 165 | 185 | | | | | | | | | | |

TABLE XXV.—(*continued*).

**LOGARITHMS OF NUMBERS**

No. 2350 to 2849 — Log. 371068 to 454692

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 235 | 371068 | 371253 | 371437 | 371622 | 371806 | 371991 | 372175 | 372360 | 372544 | 372728 | 184 |
| 236 | 372912 | 373096 | 373280 | 373464 | 373647 | 373831 | 374015 | 374198 | 374382 | 374565 | 184 |
| 237 | 374748 | 374932 | 375115 | 375298 | 375481 | 375664 | 375846 | 376029 | 376212 | 376394 | 183 |
| 238 | 376577 | 376759 | 376942 | 377124 | 377306 | 377488 | 377670 | 377852 | 378034 | 378216 | 182 |
| 239 | 378398 | 378580 | 378761 | 378943 | 379124 | 379306 | 379487 | 379668 | 379849 | 380030 | 181 |
| 240 | 380211 | 380392 | 380573 | 380754 | 380934 | 381115 | 381296 | 381476 | 381656 | 381837 | 181 |
| 241 | 382017 | 382197 | 382377 | 382557 | 382737 | 382917 | 383097 | 383277 | 383456 | 383636 | 180 |
| 242 | 383815 | 383995 | 384174 | 384353 | 384533 | 384712 | 384891 | 385070 | 385249 | 385428 | 179 |
| 243 | 385606 | 385785 | 385964 | 386142 | 386321 | 386499 | 386677 | 386856 | 387034 | 387212 | 178 |
| 244 | 387390 | 387568 | 387746 | 387923 | 388101 | 388279 | 388456 | 388634 | 388811 | 388989 | 178 |
| 245 | 389166 | 389343 | 389520 | 389698 | 389875 | 390051 | 390228 | 390405 | 390582 | 390759 | 177 |
| 246 | 390935 | 391112 | 391288 | 391464 | 391641 | 391817 | 391993 | 392169 | 392345 | 392521 | 176 |
| 247 | 392697 | 392873 | 393048 | 393224 | 393400 | 393575 | 393751 | 393926 | 394101 | 394277 | 176 |
| 248 | 394452 | 394627 | 394802 | 394977 | 395152 | 395326 | 395501 | 395676 | 395850 | 396025 | 175 |
| 249 | 396199 | 396374 | 396548 | 396722 | 396896 | 397071 | 397245 | 397419 | 397592 | 397766 | 174 |
| 250 | 397940 | 398114 | 398287 | 398461 | 398634 | 398808 | 398981 | 399154 | 399328 | 399501 | 173 |
| 251 | 399674 | 399847 | 400020 | 400192 | 400365 | 400538 | 400711 | 400883 | 401056 | 401228 | 173 |
| 252 | 401401 | 401573 | 401745 | 401917 | 402089 | 402261 | 402433 | 402605 | 402777 | 402949 | 172 |
| 253 | 403121 | 403292 | 403464 | 403635 | 403807 | 403978 | 404149 | 404320 | 404492 | 404663 | 171 |
| 254 | 404834 | 405005 | 405176 | 405346 | 405517 | 405688 | 405858 | 406029 | 406199 | 406370 | 171 |
| 255 | 406540 | 406710 | 406881 | 407051 | 407221 | 407391 | 407561 | 407731 | 407901 | 408070 | 170 |
| 256 | 408240 | 408410 | 408579 | 408749 | 408918 | 409087 | 409257 | 409426 | 409595 | 409764 | 169 |
| 257 | 409933 | 410102 | 410271 | 410440 | 410609 | 410777 | 410946 | 411114 | 411283 | 411451 | 169 |
| 258 | 411620 | 411788 | 411956 | 412124 | 412293 | 412461 | 412629 | 412796 | 412964 | 413132 | 168 |
| 259 | 413300 | 413467 | 413635 | 413803 | 413970 | 414137 | 414305 | 414472 | 414639 | 414806 | 167 |
| 260 | 414973 | 415140 | 415307 | 415474 | 415641 | 415808 | 415974 | 416141 | 416308 | 416474 | 167 |
| 261 | 416641 | 416807 | 416973 | 417139 | 417306 | 417472 | 417638 | 417804 | 417970 | 418135 | 166 |
| 262 | 418301 | 418467 | 418633 | 418798 | 418964 | 419129 | 419295 | 419460 | 419625 | 419791 | 165 |
| 263 | 419956 | 420121 | 420286 | 420451 | 420616 | 420781 | 420945 | 421110 | 421275 | 421439 | 165 |
| 264 | 421604 | 421768 | 421933 | 422097 | 422261 | 422426 | 422590 | 422754 | 422918 | 423082 | 164 |
| 265 | 423246 | 423410 | 423574 | 423737 | 423901 | 424065 | 424228 | 424392 | 424555 | 424718 | 164 |
| 266 | 424882 | 425045 | 425208 | 425371 | 425534 | 425697 | 425860 | 426023 | 426186 | 426349 | 163 |
| 267 | 426511 | 426674 | 426836 | 426999 | 427161 | 427324 | 427486 | 427648 | 427811 | 427973 | 162 |
| 268 | 428135 | 428297 | 428459 | 428621 | 428783 | 428944 | 429106 | 429268 | 429429 | 429591 | 162 |
| 269 | 429752 | 429914 | 430075 | 430236 | 430398 | 430559 | 430720 | 430881 | 431042 | 431203 | 161 |
| 270 | 431364 | 431525 | 431685 | 431846 | 432007 | 432167 | 432328 | 432488 | 432649 | 432809 | 161 |
| 271 | 432969 | 433130 | 433290 | 433450 | 433610 | 433770 | 433930 | 434090 | 434249 | 434409 | 160 |
| 272 | 434569 | 434729 | 434888 | 435048 | 435207 | 435367 | 435526 | 435685 | 435844 | 436004 | 159 |
| 273 | 436163 | 436322 | 436481 | 436640 | 436799 | 436957 | 437116 | 437275 | 437433 | 437592 | 159 |
| 274 | 437751 | 437909 | 438067 | 438226 | 438384 | 438542 | 438701 | 438859 | 439017 | 439175 | 158 |
| 275 | 439333 | 439491 | 439648 | 439806 | 439964 | 440122 | 440279 | 440437 | 440594 | 440752 | 158 |
| 276 | 440909 | 441066 | 441224 | 441381 | 441538 | 441695 | 441852 | 442009 | 442166 | 442323 | 157 |
| 277 | 442480 | 442637 | 442793 | 442950 | 443106 | 443263 | 443419 | 443576 | 443732 | 443889 | 157 |
| 278 | 444045 | 444201 | 444357 | 444513 | 444669 | 444825 | 444981 | 445137 | 445293 | 445449 | 156 |
| 279 | 445604 | 445760 | 445915 | 446071 | 446226 | 446382 | 446537 | 446692 | 446848 | 447003 | 155 |
| 280 | 447158 | 447313 | 447468 | 447623 | 447778 | 447933 | 448088 | 448242 | 448397 | 448552 | 155 |
| 281 | 448706 | 448861 | 449015 | 449170 | 449324 | 449478 | 449633 | 449787 | 449941 | 450095 | 154 |
| 282 | 450249 | 450403 | 450557 | 450711 | 450865 | 451018 | 451172 | 451326 | 451479 | 451633 | 154 |
| 283 | 451786 | 451940 | 452093 | 452247 | 452400 | 452553 | 452706 | 452859 | 453012 | 453165 | 153 |
| 284 | 453318 | 453471 | 453624 | 453777 | 453930 | 454082 | 454235 | 454387 | 454540 | 454692 | 153 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 152 | 15 | 30 | 46 | 61 | 76 | 91 | 106 | 122 | 137 | 170 | 17 | 34 | 51 | 68 | 85 | 102 | 119 | 136 | 153 |
| 154 | 15 | 31 | 46 | 62 | 77 | 92 | 108 | 123 | 139 | 172 | 17 | 34 | 52 | 69 | 86 | 103 | 120 | 138 | 155 |
| 156 | 16 | 31 | 47 | 62 | 78 | 94 | 109 | 125 | 140 | 174 | 17 | 35 | 52 | 70 | 87 | 104 | 122 | 139 | 157 |
| 158 | 16 | 32 | 47 | 63 | 79 | 95 | 111 | 126 | 142 | 176 | 18 | 35 | 53 | 70 | 88 | 106 | 123 | 141 | 158 |
| 160 | 16 | 32 | 48 | 64 | 80 | 96 | 112 | 128 | 144 | 178 | 18 | 36 | 53 | 71 | 89 | 107 | 125 | 142 | 160 |
| 162 | 16 | 32 | 49 | 65 | 81 | 97 | 113 | 130 | 146 | 180 | 18 | 36 | 54 | 72 | 90 | 108 | 126 | 144 | 162 |
| 164 | 16 | 33 | 49 | 66 | 82 | 98 | 115 | 131 | 148 | 182 | 18 | 36 | 55 | 73 | 91 | 109 | 127 | 146 | 164 |
| 166 | 17 | 33 | 50 | 66 | 83 | 100 | 116 | 133 | 149 | 184 | 18 | 37 | 55 | 74 | 92 | 110 | 129 | 147 | 166 |
| 168 | 17 | 34 | 50 | 67 | 84 | 101 | 118 | 134 | 151 | | | | | | | | | | |

## TABLE XXV.—(*continued*).

### LOGARITHMS OF NUMBERS

No. 2850 to 3349 Log. 454845 to 524915

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 285 | 454845 | 454997 | 455150 | 455302 | 455454 | 455606 | 455758 | 455910 | 456062 | 456214 | 152 |
| 286 | 456366 | 456518 | 456670 | 456821 | 456973 | 457125 | 457276 | 457428 | 457579 | 457731 | 152 |
| 287 | 457882 | 458033 | 458184 | 458336 | 458487 | 458638 | 458789 | 458940 | 459091 | 459242 | 151 |
| 288 | 459392 | 459543 | 459694 | 459845 | 459995 | 460146 | 460296 | 460447 | 460597 | 460748 | 151 |
| 289 | 460898 | 461048 | 461198 | 461348 | 461499 | 461649 | 461799 | 461948 | 462098 | 462248 | 150 |
| 290 | 462398 | 462548 | 462697 | 462847 | 462997 | 463146 | 463296 | 463445 | 463594 | 463744 | 150 |
| 291 | 463893 | 464042 | 464191 | 464340 | 464490 | 464639 | 464788 | 464936 | 465085 | 465234 | 149 |
| 292 | 465383 | 465532 | 465680 | 465829 | 465977 | 466126 | 466274 | 466423 | 466571 | 466719 | 149 |
| 293 | 466868 | 467016 | 467164 | 467312 | 467460 | 467608 | 467756 | 467904 | 468052 | 468200 | 148 |
| 294 | 468347 | 468495 | 468643 | 468790 | 468938 | 469085 | 469233 | 469380 | 469527 | 469675 | 148 |
| 295 | 469822 | 469969 | 470116 | 470263 | 470410 | 470557 | 470704 | 470851 | 470998 | 471145 | 147 |
| 296 | 471292 | 471438 | 471585 | 471732 | 471878 | 472025 | 472171 | 472318 | 472464 | 472610 | 146 |
| 297 | 472756 | 472903 | 473049 | 473195 | 473341 | 473487 | 473633 | 473779 | 473925 | 474071 | 146 |
| 298 | 474216 | 474362 | 474508 | 474653 | 474799 | 474944 | 475090 | 475235 | 475381 | 475526 | 146 |
| 299 | 475671 | 475816 | 475962 | 476107 | 476252 | 476397 | 476542 | 476687 | 476832 | 476976 | 145 |
| 300 | 477121 | 477266 | 477411 | 477555 | 477700 | 477844 | 477989 | 478133 | 478278 | 478422 | 145 |
| 301 | 478566 | 478711 | 478855 | 478999 | 479143 | 479287 | 479431 | 479575 | 479719 | 479863 | 144 |
| 302 | 480007 | 480151 | 480294 | 480438 | 480582 | 480725 | 480869 | 481012 | 481156 | 481299 | 144 |
| 303 | 481443 | 481586 | 481729 | 481872 | 482016 | 482159 | 482302 | 482445 | 482588 | 482731 | 143 |
| 304 | 482874 | 483016 | 483159 | 483302 | 483445 | 483587 | 483730 | 483872 | 484015 | 484157 | 143 |
| 305 | 484300 | 484442 | 484585 | 484727 | 484869 | 485011 | 485153 | 485295 | 485437 | 485579 | 142 |
| 306 | 485721 | 485863 | 486005 | 486147 | 486289 | 486430 | 486572 | 486714 | 486855 | 486997 | 142 |
| 307 | 487138 | 487280 | 487421 | 487563 | 487704 | 487845 | 487986 | 488127 | 488269 | 488410 | 141 |
| 308 | 488551 | 488692 | 488833 | 488974 | 489114 | 489255 | 489396 | 489537 | 489677 | 489818 | 141 |
| 309 | 489958 | 490099 | 490239 | 490380 | 490520 | 490661 | 490801 | 490941 | 491081 | 491222 | 140 |
| 310 | 491362 | 491502 | 491642 | 491782 | 491922 | 492062 | 492201 | 492341 | 492481 | 492621 | 140 |
| 311 | 492760 | 492900 | 493040 | 493179 | 493319 | 493458 | 493597 | 493737 | 493876 | 494015 | 139 |
| 312 | 494155 | 494294 | 494433 | 494572 | 494711 | 494850 | 494989 | 495128 | 495267 | 495406 | 139 |
| 313 | 495544 | 495683 | 495822 | 495960 | 496099 | 496238 | 496376 | 496515 | 496653 | 496791 | 139 |
| 314 | 496930 | 497068 | 497206 | 497344 | 497483 | 497621 | 497759 | 497897 | 498035 | 498173 | 138 |
| 315 | 498311 | 498448 | 498586 | 498724 | 498862 | 498999 | 499137 | 499275 | 499412 | 499550 | 138 |
| 316 | 499687 | 499824 | 499962 | 500099 | 500236 | 500374 | 500511 | 500648 | 500785 | 500922 | 137 |
| 317 | 501059 | 501196 | 501333 | 501470 | 501607 | 501744 | 501880 | 502017 | 502154 | 502291 | 137 |
| 318 | 502427 | 502564 | 502700 | 502837 | 502973 | 503109 | 503246 | 503382 | 503518 | 503655 | 136 |
| 319 | 503791 | 503927 | 504063 | 504199 | 504335 | 504471 | 504607 | 504743 | 504878 | 505014 | 136 |
| 320 | 505150 | 505286 | 505421 | 505557 | 505693 | 505828 | 505964 | 506099 | 506234 | 506370 | 136 |
| 321 | 506505 | 506640 | 506776 | 506911 | 507046 | 507181 | 507316 | 507451 | 507586 | 507721 | 135 |
| 322 | 507856 | 507991 | 508126 | 508260 | 508395 | 508530 | 508664 | 508799 | 508934 | 509068 | 135 |
| 323 | 509203 | 509337 | 509471 | 509606 | 509740 | 509874 | 510009 | 510143 | 510277 | 510411 | 134 |
| 324 | 510545 | 510679 | 510813 | 510947 | 511081 | 511215 | 511349 | 511482 | 511616 | 511750 | 134 |
| 325 | 511883 | 512017 | 512151 | 512284 | 512418 | 512551 | 512684 | 512818 | 512951 | 513084 | 133 |
| 326 | 513218 | 513351 | 513484 | 513617 | 513750 | 513883 | 514016 | 514149 | 514282 | 514415 | 133 |
| 327 | 514548 | 514681 | 514813 | 514946 | 515079 | 515211 | 515344 | 515476 | 515609 | 515741 | 133 |
| 328 | 515874 | 516006 | 516139 | 516271 | 516403 | 516535 | 516668 | 516800 | 516932 | 517064 | 132 |
| 329 | 517196 | 517328 | 517460 | 517592 | 517724 | 517855 | 517987 | 518119 | 518251 | 518382 | 132 |
| 330 | 518514 | 518646 | 518777 | 518909 | 519040 | 519171 | 519303 | 519434 | 519566 | 519697 | 131 |
| 331 | 519828 | 519959 | 520090 | 520221 | 520353 | 520484 | 520615 | 520745 | 520876 | 521007 | 131 |
| 332 | 521138 | 521269 | 521400 | 521530 | 521661 | 521792 | 521922 | 522053 | 522183 | 522314 | 131 |
| 333 | 522444 | 522575 | 522705 | 522835 | 522966 | 523096 | 523226 | 523356 | 523486 | 523616 | 130 |
| 334 | 523746 | 523876 | 524006 | 524136 | 524266 | 524396 | 524526 | 524656 | 524785 | 524915 | 130 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 130 | 13 | 26 | 39 | 52 | 65 | 78 | 91 | 104 | 117 |
| 132 | 13 | 26 | 40 | 53 | 66 | 79 | 92 | 106 | 119 |
| 134 | 13 | 27 | 40 | 54 | 67 | 80 | 94 | 107 | 121 |
| 136 | 14 | 27 | 41 | 54 | 68 | 82 | 95 | 109 | 122 |
| 138 | 14 | 28 | 41 | 55 | 69 | 83 | 97 | 110 | 124 |
| 140 | 14 | 28 | 42 | 56 | 70 | 84 | 98 | 112 | 126 |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 142 | 14 | 28 | 43 | 57 | 71 | 85 | 99 | 114 | 128 |
| 144 | 14 | 29 | 43 | 58 | 72 | 86 | 101 | 115 | 130 |
| 146 | 15 | 29 | 44 | 58 | 73 | 88 | 102 | 117 | 131 |
| 148 | 15 | 30 | 44 | 59 | 74 | 89 | 104 | 118 | 133 |
| 150 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 |
| 152 | 15 | 30 | 46 | 61 | 76 | 91 | 106 | 122 | 137 |

TABLE XXV.—(*continued*).

**LOGARITHMS OF NUMBERS**

No. 3350 to 3899 — Log. 525045 to 590953

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 335 | 525045 | 525174 | 525304 | 525434 | 525563 | 525693 | 525822 | 525951 | 526081 | 526210 | 129 |
| 336 | 526339 | 526469 | 526598 | 526727 | 526856 | 526985 | 527114 | 527243 | 527372 | 527501 | 129 |
| 337 | 527630 | 527759 | 527888 | 528016 | 528145 | 528274 | 528402 | 528531 | 528660 | 528788 | 129 |
| 338 | 528917 | 529045 | 529174 | 529302 | 529430 | 529559 | 529687 | 529815 | 529943 | 530072 | 128 |
| 339 | 530200 | 530328 | 530456 | 530584 | 530712 | 530840 | 530968 | 531096 | 531223 | 531351 | 128 |
| 340 | 531479 | 531607 | 531734 | 531862 | 531990 | 532117 | 532245 | 532372 | 532500 | 532627 | 128 |
| 341 | 532754 | 532882 | 533009 | 533136 | 533264 | 533391 | 533518 | 533645 | 533772 | 533899 | 127 |
| 342 | 534026 | 534153 | 534280 | 534407 | 534534 | 534661 | 534787 | 534914 | 535041 | 535167 | 127 |
| 343 | 535294 | 535421 | 535547 | 535674 | 535800 | 535927 | 536053 | 536180 | 536306 | 536432 | 126 |
| 344 | 536558 | 536685 | 536811 | 536937 | 537063 | 537189 | 537315 | 537441 | 537567 | 537693 | 126 |
| 345 | 537819 | 537945 | 538071 | 538197 | 538322 | 538448 | 538574 | 538699 | 538825 | 538951 | 126 |
| 346 | 539076 | 539202 | 539327 | 539452 | 539578 | 539703 | 539829 | 539954 | 540079 | 540204 | 125 |
| 347 | 540329 | 540455 | 540580 | 540705 | 540830 | 540955 | 541080 | 541205 | 541330 | 541454 | 125 |
| 348 | 541579 | 541704 | 541829 | 541953 | 542078 | 542203 | 542327 | 542452 | 542576 | 542701 | 125 |
| 349 | 542825 | 542950 | 543074 | 543199 | 543323 | 543447 | 543571 | 543696 | 543820 | 543944 | 124 |
| 350 | 544068 | 544192 | 544316 | 544440 | 544564 | 544688 | 544812 | 544936 | 545060 | 545183 | 124 |
| 351 | 545307 | 545431 | 545555 | 545678 | 545802 | 545925 | 546049 | 546172 | 546296 | 546419 | 124 |
| 352 | 546543 | 546666 | 546789 | 546913 | 547036 | 547159 | 547282 | 547405 | 547529 | 547652 | 123 |
| 353 | 547775 | 547898 | 548021 | 548144 | 548267 | 548389 | 548512 | 548635 | 548758 | 548881 | 123 |
| 354 | 549003 | 549126 | 549249 | 549371 | 549494 | 549616 | 549739 | 549861 | 549984 | 550106 | 123 |
| 355 | 550228 | 550351 | 550473 | 550595 | 550717 | 550840 | 550962 | 551084 | 551206 | 551328 | 122 |
| 356 | 551450 | 551572 | 551694 | 551816 | 551938 | 552060 | 552181 | 552303 | 552425 | 552547 | 122 |
| 357 | 552668 | 552790 | 552911 | 553033 | 553155 | 553276 | 553398 | 553519 | 553640 | 553762 | 121 |
| 358 | 553883 | 554004 | 554126 | 554247 | 554368 | 554489 | 554610 | 554731 | 554852 | 554973 | 121 |
| 359 | 555094 | 555215 | 555336 | 555457 | 555578 | 555699 | 555820 | 555940 | 556061 | 556182 | 121 |
| 360 | 556303 | 556423 | 556544 | 556664 | 556785 | 556905 | 557026 | 557146 | 557267 | 557387 | 120 |
| 361 | 557507 | 557627 | 557748 | 557868 | 557988 | 558108 | 558228 | 558349 | 558469 | 558589 | 120 |
| 362 | 558709 | 558829 | 558948 | 559068 | 559188 | 559308 | 559428 | 559548 | 559667 | 559787 | 120 |
| 363 | 559907 | 560026 | 560146 | 560265 | 560385 | 560504 | 560624 | 560743 | 560863 | 560982 | 119 |
| 364 | 561101 | 561221 | 561340 | 561459 | 561578 | 561698 | 561817 | 561936 | 562055 | 562174 | 119 |
| 365 | 562293 | 562412 | 562531 | 562650 | 562769 | 562887 | 563006 | 563125 | 563244 | 563362 | 119 |
| 366 | 563481 | 563600 | 563718 | 563837 | 563955 | 564074 | 564192 | 564311 | 564429 | 564548 | 119 |
| 367 | 564666 | 564784 | 564903 | 565021 | 565139 | 565257 | 565376 | 565494 | 565612 | 565730 | 118 |
| 368 | 565848 | 565966 | 566084 | 566202 | 566320 | 566437 | 566555 | 566673 | 566791 | 566909 | 118 |
| 369 | 567026 | 567144 | 567262 | 567379 | 567497 | 567614 | 567732 | 567849 | 567967 | 568084 | 118 |
| 370 | 568202 | 568319 | 568436 | 568554 | 568671 | 568788 | 568905 | 569023 | 569140 | 569257 | 117 |
| 371 | 569374 | 569491 | 569608 | 569725 | 569842 | 569959 | 570076 | 570193 | 570309 | 570426 | 117 |
| 372 | 570543 | 570660 | 570776 | 570893 | 571010 | 571126 | 571243 | 571359 | 571476 | 571592 | 117 |
| 373 | 571709 | 571825 | 571942 | 572058 | 572174 | 572291 | 572407 | 572523 | 572639 | 572755 | 116 |
| 374 | 572872 | 572988 | 573104 | 573220 | 573336 | 573452 | 573568 | 573684 | 573800 | 573915 | 116 |
| 375 | 574031 | 574147 | 574263 | 574379 | 574494 | 574610 | 574726 | 574841 | 574957 | 575072 | 116 |
| 376 | 575188 | 575303 | 575419 | 575534 | 575650 | 575765 | 575880 | 575996 | 576111 | 576226 | 115 |
| 377 | 576341 | 576457 | 576572 | 576687 | 576802 | 576917 | 577032 | 577147 | 577262 | 577377 | 115 |
| 378 | 577492 | 577607 | 577722 | 577836 | 577951 | 578066 | 578181 | 578295 | 578410 | 578525 | 115 |
| 379 | 578639 | 578754 | 578868 | 578983 | 579097 | 579212 | 579326 | 579441 | 579555 | 579669 | 114 |
| 380 | 579784 | 579898 | 580012 | 580126 | 580241 | 580355 | 580469 | 580583 | 580697 | 580811 | 114 |
| 381 | 580925 | 581039 | 581153 | 581267 | 581381 | 581495 | 581608 | 581722 | 581836 | 581950 | 114 |
| 382 | 582063 | 582177 | 582291 | 582404 | 582518 | 582631 | 582745 | 582858 | 582972 | 583085 | 114 |
| 383 | 583199 | 583312 | 583426 | 583539 | 583652 | 583765 | 583879 | 583992 | 584105 | 584218 | 113 |
| 384 | 584331 | 584444 | 584557 | 584670 | 584783 | 584896 | 585009 | 585122 | 585235 | 585348 | 113 |
| 385 | 585461 | 585574 | 585686 | 585799 | 585912 | 586024 | 586137 | 586250 | 586362 | 586475 | 113 |
| 386 | 586587 | 586700 | 586812 | 586925 | 587037 | 587149 | 587262 | 587374 | 587486 | 587599 | 112 |
| 387 | 587711 | 587823 | 587935 | 588047 | 588160 | 588272 | 588384 | 588496 | 588608 | 588720 | 112 |
| 388 | 588832 | 588944 | 589056 | 589167 | 589279 | 589391 | 589503 | 589615 | 589726 | 589838 | 112 |
| 389 | 589950 | 590061 | 590173 | 590284 | 590396 | 590507 | 590619 | 590730 | 590842 | 590953 | 112 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 112 | 11 | 22 | 34 | 45 | 56 | 67 | 78 | 90 | 101 | 122 | 12 | 24 | 37 | 49 | 61 | 73 | 85 | 98 | 110 |
| 114 | 11 | 23 | 34 | 46 | 57 | 68 | 80 | 91 | 103 | 124 | 12 | 25 | 37 | 50 | 62 | 74 | 87 | 99 | 112 |
| 116 | 12 | 23 | 35 | 46 | 58 | 70 | 81 | 93 | 104 | 126 | 13 | 25 | 38 | 50 | 63 | 76 | 88 | 101 | 113 |
| 118 | 12 | 24 | 35 | 47 | 59 | 71 | 83 | 94 | 106 | 128 | 13 | 26 | 38 | 51 | 64 | 77 | 90 | 102 | 115 |
| 120 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 130 | 13 | 26 | 39 | 52 | 65 | 78 | 01 | 104 | 117 |

## TABLE XXV.—*(continued).*

### LOGARITHMS OF NUMBERS

No. 3900 to 4449 Log. 591065 to 648262

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 390 | 591065 | 591176 | 591287 | 591399 | 591510 | 591621 | 591732 | 591843 | 591955 | 592066 | 111 |
| 391 | 592177 | 592288 | 592399 | 592510 | 592621 | 592732 | 592843 | 592954 | 593064 | 593175 | 111 |
| 392 | 593286 | 593397 | 593508 | 593618 | 593729 | 593840 | 593950 | 594061 | 594171 | 594282 | 111 |
| 393 | 594393 | 594503 | 594614 | 594724 | 594834 | 594945 | 595055 | 595165 | 595276 | 595386 | 110 |
| 394 | 595496 | 595606 | 595717 | 595827 | 595937 | 596047 | 596157 | 596267 | 596377 | 596487 | 110 |
| 395 | 596597 | 596707 | 596817 | 596927 | 597037 | 597146 | 597256 | 597366 | 597476 | 597586 | 110 |
| 396 | 597695 | 597805 | 597914 | 598024 | 598134 | 598243 | 598353 | 598462 | 598572 | 598681 | 110 |
| 397 | 598791 | 598900 | 599009 | 599119 | 599228 | 599337 | 599446 | 599556 | 599665 | 599774 | 109 |
| 398 | 599883 | 599992 | 600101 | 600210 | 600319 | 600428 | 600537 | 600646 | 600755 | 600864 | 109 |
| 399 | 600973 | 601082 | 601191 | 601299 | 601408 | 601517 | 601625 | 601734 | 601843 | 601951 | 109 |
| 400 | 602060 | 602169 | 602277 | 602386 | 602494 | 602603 | 602711 | 602819 | 602928 | 603036 | 108 |
| 401 | 603144 | 603253 | 603361 | 603469 | 603577 | 603686 | 603794 | 603902 | 604010 | 604118 | 108 |
| 402 | 604226 | 604334 | 604442 | 604550 | 604658 | 604766 | 604874 | 604982 | 605089 | 605197 | 108 |
| 403 | 605305 | 605413 | 605521 | 605628 | 605736 | 605844 | 605951 | 606059 | 606166 | 606274 | 108 |
| 404 | 606381 | 606489 | 606596 | 606704 | 606811 | 606919 | 607026 | 607133 | 607241 | 607348 | 107 |
| 405 | 607455 | 607562 | 607669 | 607777 | 607884 | 607991 | 608098 | 608205 | 608312 | 608419 | 107 |
| 406 | 608526 | 608633 | 608740 | 608847 | 608954 | 609061 | 609167 | 609274 | 609381 | 609488 | 107 |
| 407 | 609594 | 609701 | 609808 | 609914 | 610021 | 610128 | 610234 | 610341 | 610447 | 610554 | 107 |
| 408 | 610660 | 610767 | 610873 | 610979 | 611086 | 611192 | 611298 | 611405 | 611511 | 611617 | 106 |
| 409 | 611723 | 611829 | 611936 | 612042 | 612148 | 612254 | 612360 | 612466 | 612572 | 612678 | 106 |
| 410 | 612784 | 612890 | 612996 | 613102 | 613207 | 613313 | 613419 | 613525 | 613630 | 613736 | 106 |
| 411 | 613842 | 613947 | 614053 | 614159 | 614264 | 614370 | 614475 | 614581 | 614686 | 614792 | 106 |
| 412 | 614897 | 615003 | 615108 | 615213 | 615319 | 615424 | 615529 | 615634 | 615740 | 615845 | 105 |
| 413 | 615950 | 616055 | 616160 | 616265 | 616370 | 616476 | 616581 | 616686 | 616790 | 616895 | 105 |
| 414 | 617000 | 617105 | 617210 | 617315 | 617420 | 617525 | 617629 | 617734 | 617839 | 617943 | 105 |
| 415 | 618048 | 618153 | 618257 | 618362 | 618466 | 618571 | 618676 | 618780 | 618884 | 618989 | 105 |
| 416 | 619093 | 619198 | 619302 | 619406 | 619511 | 619615 | 619719 | 619824 | 619928 | 620032 | 104 |
| 417 | 620136 | 620240 | 620344 | 620448 | 620552 | 620656 | 620760 | 620864 | 620968 | 621072 | 104 |
| 418 | 621176 | 621280 | 621384 | 621488 | 621592 | 621695 | 621799 | 621903 | 622007 | 622110 | 104 |
| 419 | 622214 | 622318 | 622421 | 622525 | 622628 | 622732 | 622835 | 622939 | 623042 | 623146 | 104 |
| 420 | 623249 | 623353 | 623456 | 623559 | 623663 | 623766 | 623869 | 623973 | 624076 | 624179 | 103 |
| 421 | 624282 | 624385 | 624488 | 624591 | 624695 | 624798 | 624901 | 625004 | 625107 | 625210 | 103 |
| 422 | 625312 | 625415 | 625518 | 625621 | 625724 | 625827 | 625929 | 626032 | 626135 | 626238 | 103 |
| 423 | 626340 | 626443 | 626546 | 626648 | 626751 | 626853 | 626956 | 627058 | 627161 | 627263 | 103 |
| 424 | 627366 | 627468 | 627571 | 627673 | 627775 | 627878 | 627980 | 628082 | 628185 | 628287 | 102 |
| 425 | 628389 | 628491 | 628593 | 628695 | 628797 | 628900 | 629002 | 629104 | 629206 | 629308 | 102 |
| 426 | 629410 | 629512 | 629613 | 629715 | 629817 | 629919 | 630021 | 630123 | 630224 | 630326 | 102 |
| 427 | 630428 | 630530 | 630631 | 630733 | 630835 | 630936 | 631038 | 631139 | 631241 | 631342 | 102 |
| 428 | 631444 | 631545 | 631647 | 631748 | 631849 | 631951 | 632052 | 632153 | 632255 | 632356 | 101 |
| 429 | 632457 | 632559 | 632660 | 632761 | 632862 | 632963 | 633064 | 633165 | 633266 | 633367 | 101 |
| 430 | 633468 | 633569 | 633670 | 633771 | 633872 | 633973 | 634074 | 634175 | 634276 | 634376 | 101 |
| 431 | 634477 | 634578 | 634679 | 634779 | 634880 | 634981 | 635081 | 635182 | 635283 | 635383 | 101 |
| 432 | 635484 | 635584 | 635685 | 635785 | 635886 | 635986 | 636087 | 636187 | 636287 | 636388 | 100 |
| 433 | 636488 | 636588 | 636688 | 636789 | 636889 | 636989 | 637089 | 637189 | 637290 | 637390 | 100 |
| 434 | 637490 | 637590 | 637690 | 637790 | 637890 | 637990 | 638090 | 638190 | 638290 | 638389 | 100 |
| 435 | 638489 | 638589 | 638689 | 638789 | 638888 | 638988 | 639088 | 639188 | 639287 | 639387 | 100 |
| 436 | 639486 | 639586 | 639686 | 639785 | 639885 | 639984 | 640084 | 640183 | 640283 | 640382 | 99 |
| 437 | 640481 | 640581 | 640680 | 640779 | 640879 | 640978 | 641077 | 641177 | 641276 | 641375 | 99 |
| 438 | 641474 | 641573 | 641672 | 641771 | 641871 | 641970 | 642069 | 642168 | 642267 | 642366 | 99 |
| 439 | 642465 | 642563 | 642662 | 642761 | 642860 | 642959 | 643058 | 643156 | 643255 | 643354 | 99 |
| 440 | 643453 | 643551 | 643650 | 643749 | 643847 | 643946 | 644044 | 644143 | 644242 | 644340 | 99 |
| 441 | 644439 | 644537 | 644636 | 644734 | 644832 | 644931 | 645029 | 645127 | 645226 | 645324 | 98 |
| 442 | 645422 | 645521 | 645619 | 645717 | 645815 | 645913 | 646011 | 646110 | 646208 | 646306 | 98 |
| 443 | 646404 | 646502 | 646600 | 646698 | 646796 | 646894 | 646992 | 647089 | 647187 | 647285 | 98 |
| 444 | 647383 | 647481 | 647579 | 647676 | 647774 | 647872 | 647969 | 648067 | 648165 | 648262 | 98 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 98 | 10 | 20 | 29 | 39 | 49 | 59 | 69 | 78 | 88 | 106 | 11 | 21 | 32 | 42 | 53 | 64 | 74 | 85 | 95 |
| 100 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 108 | 11 | 22 | 32 | 43 | 54 | 65 | 76 | 86 | 97 |
| 102 | 10 | 20 | 31 | 41 | 51 | 61 | 71 | 82 | 92 | 110 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 |
| 104 | 10 | 21 | 31 | 42 | 52 | 62 | 73 | 83 | 94 | 112 | 11 | 22 | 34 | 45 | 56 | 67 | 78 | 90 | 101 |

TABLE XXV.—(*continued*).

LOGARITHMS OF NUMBERS

No. 4450 to 4999 Log. 648360 to 698883

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 445 | 648360 | 648458 | 648555 | 648653 | 648750 | 648848 | 648945 | 649043 | 649140 | 649237 | 97 |
| 446 | 649335 | 649432 | 649530 | 649627 | 649724 | 649821 | 649919 | 650016 | 650113 | 650210 | 97 |
| 447 | 650308 | 650405 | 650502 | 650599 | 650696 | 650793 | 650890 | 650987 | 651084 | 651181 | 97 |
| 448 | 651278 | 651375 | 651472 | 651569 | 651666 | 651762 | 651859 | 651956 | 652053 | 652150 | 97 |
| 449 | 652246 | 652343 | 652440 | 652536 | 652633 | 652730 | 652826 | 652923 | 653019 | 653116 | 97 |
| 450 | 653213 | 653309 | 653405 | 653502 | 653598 | 653695 | 653791 | 653888 | 653984 | 654080 | 96 |
| 451 | 654177 | 654273 | 654369 | 654465 | 654562 | 654658 | 654754 | 654850 | 654946 | 655042 | 96 |
| 452 | 655138 | 655235 | 655331 | 655427 | 655523 | 655619 | 655715 | 655810 | 655906 | 656002 | 96 |
| 453 | 656098 | 656194 | 656290 | 656386 | 656482 | 656577 | 656673 | 656769 | 656864 | 656960 | 96 |
| 454 | 657056 | 657152 | 657247 | 657343 | 657438 | 657534 | 657629 | 657725 | 657820 | 657916 | 96 |
| 455 | 658011 | 658107 | 658202 | 658298 | 658393 | 658488 | 658584 | 658679 | 658774 | 658870 | 95 |
| 456 | 658965 | 659060 | 659155 | 659250 | 659346 | 659441 | 659536 | 659631 | 659726 | 659821 | 95 |
| 457 | 659916 | 660011 | 660106 | 660201 | 660296 | 660391 | 660486 | 660581 | 660676 | 660771 | 95 |
| 458 | 660865 | 660960 | 661055 | 661150 | 661245 | 661339 | 661434 | 661529 | 661623 | 661718 | 95 |
| 459 | 661813 | 661907 | 662002 | 662096 | 662191 | 662286 | 662380 | 662475 | 662569 | 662663 | 95 |
| 460 | 662758 | 662852 | 662947 | 663041 | 663135 | 663230 | 663324 | 663418 | 663512 | 663607 | 94 |
| 461 | 663701 | 663795 | 663889 | 663983 | 664078 | 664172 | 664266 | 664360 | 664454 | 664548 | 94 |
| 462 | 664642 | 664736 | 664830 | 664924 | 665018 | 665112 | 665206 | 665299 | 665393 | 665487 | 94 |
| 463 | 665581 | 665675 | 665769 | 665862 | 665956 | 666050 | 666143 | 666237 | 666331 | 666424 | 94 |
| 464 | 666518 | 666612 | 666705 | 666799 | 666892 | 666986 | 667079 | 667173 | 667266 | 667360 | 94 |
| 465 | 667453 | 667546 | 667640 | 667733 | 667826 | 667920 | 668013 | 668106 | 668199 | 668293 | 93 |
| 466 | 668386 | 668479 | 668572 | 668665 | 668759 | 668852 | 668945 | 669038 | 669131 | 669224 | 93 |
| 467 | 669317 | 669410 | 669503 | 669596 | 669689 | 669782 | 669875 | 669967 | 670060 | 670153 | 93 |
| 468 | 670246 | 670339 | 670431 | 670524 | 670617 | 670710 | 670802 | 670895 | 670988 | 671080 | 93 |
| 469 | 671173 | 671265 | 671358 | 671451 | 671543 | 671636 | 671728 | 671821 | 671913 | 672005 | 93 |
| 470 | 672098 | 672190 | 672283 | 672375 | 672467 | 672560 | 672652 | 672744 | 672836 | 672929 | 92 |
| 471 | 673021 | 673113 | 673205 | 673297 | 673390 | 673482 | 673574 | 673666 | 673758 | 673850 | 92 |
| 472 | 673942 | 674034 | 674126 | 674218 | 674310 | 674402 | 674494 | 674586 | 674677 | 674769 | 92 |
| 473 | 674861 | 674953 | 675045 | 675137 | 675228 | 675320 | 675412 | 675503 | 675595 | 675687 | 92 |
| 474 | 675778 | 675870 | 675962 | 676053 | 676145 | 676236 | 676328 | 676419 | 676511 | 676602 | 92 |
| 475 | 676694 | 676785 | 676876 | 676968 | 677059 | 677151 | 677242 | 677333 | 677424 | 677516 | 91 |
| 476 | 677607 | 677698 | 677789 | 677881 | 677972 | 678063 | 678154 | 678245 | 678336 | 678427 | 91 |
| 477 | 678518 | 678609 | 678700 | 678791 | 678882 | 678973 | 679064 | 679155 | 679246 | 679337 | 91 |
| 478 | 679428 | 679519 | 679610 | 679700 | 679791 | 679882 | 679973 | 680063 | 680154 | 680245 | 91 |
| 479 | 680336 | 680426 | 680517 | 680607 | 680698 | 680789 | 680879 | 680970 | 681060 | 681151 | 91 |
| 480 | 681241 | 681332 | 681422 | 681513 | 681603 | 681693 | 681784 | 681874 | 681964 | 682055 | 90 |
| 481 | 682145 | 682235 | 682326 | 682416 | 682506 | 682596 | 682686 | 682777 | 682867 | 682957 | 90 |
| 482 | 683047 | 683137 | 683227 | 683317 | 683407 | 683497 | 683587 | 683677 | 683767 | 683857 | 90 |
| 483 | 683947 | 684037 | 684127 | 684217 | 684307 | 684396 | 684486 | 684576 | 684666 | 684756 | 90 |
| 484 | 684845 | 684935 | 685025 | 685114 | 685204 | 685294 | 685383 | 685473 | 685563 | 685652 | 90 |
| 485 | 685742 | 685831 | 685921 | 686010 | 686100 | 686189 | 686279 | 686368 | 686458 | 686547 | 89 |
| 486 | 686636 | 686726 | 686815 | 686904 | 686994 | 687083 | 687172 | 687261 | 687351 | 687440 | 89 |
| 487 | 687529 | 687618 | 687707 | 687796 | 687886 | 687975 | 688064 | 688153 | 688242 | 688331 | 89 |
| 488 | 688420 | 688509 | 688598 | 688687 | 688776 | 688865 | 688953 | 689042 | 689131 | 689220 | 89 |
| 489 | 689309 | 689398 | 689486 | 689575 | 689664 | 689753 | 689841 | 689930 | 690019 | 690107 | 89 |
| 490 | 690196 | 690285 | 690373 | 690462 | 690550 | 690639 | 690728 | 690816 | 690905 | 690993 | 89 |
| 491 | 691081 | 691170 | 691258 | 691347 | 691435 | 691524 | 691612 | 691700 | 691789 | 691877 | 88 |
| 492 | 691965 | 692053 | 692142 | 692230 | 692318 | 692406 | 692494 | 692583 | 692671 | 692759 | 88 |
| 493 | 692847 | 692935 | 693023 | 693111 | 693199 | 693287 | 693375 | 693463 | 693551 | 693639 | 88 |
| 494 | 693727 | 693815 | 693903 | 693991 | 694078 | 694166 | 694254 | 694342 | 694430 | 694517 | 88 |
| 495 | 694605 | 694693 | 694781 | 694868 | 694956 | 695044 | 695131 | 695219 | 695307 | 695394 | 88 |
| 496 | 695482 | 695569 | 695657 | 695744 | 695832 | 695919 | 696007 | 696094 | 696182 | 696269 | 87 |
| 497 | 696356 | 696444 | 696531 | 696618 | 696706 | 696793 | 696880 | 696968 | 697055 | 697142 | 87 |
| 498 | 697229 | 697317 | 607404 | 697491 | 697578 | 697665 | 697752 | 697839 | 697926 | 698014 | 87 |
| 499 | 698101 | 698188 | 698275 | 698362 | 698449 | 698535 | 698622 | 698709 | 698796 | 698883 | 87 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | 9 | 18 | 26 | 35 | 44 | 53 | 62 | 70 | 79 | 93 | 9 | 19 | 28 | 37 | 46 | 56 | 65 | 74 | 84 |
| 89 | 9 | 18 | 27 | 36 | 44 | 53 | 62 | 71 | 80 | 94 | 9 | 19 | 28 | 38 | 47 | 56 | 66 | 75 | 85 |
| 90 | 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 95 | 9 | 19 | 28 | 38 | 47 | 57 | 66 | 76 | 86 |
| 91 | 9 | 18 | 27 | 36 | 45 | 55 | 64 | 73 | 82 | 96 | 10 | 19 | 29 | 38 | 48 | 58 | 67 | 77 | 86 |
| 92 | 9 | 18 | 28 | 37 | 46 | 55 | 64 | 74 | 83 | 97 | 10 | 19 | 29 | 39 | 48 | 58 | 68 | 78 | 87 |

TABLE XXV.—(*continued*).

LOGARITHMS OF NUMBERS

No. 5000 to 5549 — Log. 698970 to 744215

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 500 | 698970 | 699057 | 699144 | 699231 | 699317 | 699404 | 699491 | 699578 | 699664 | 699751 | 87 |
| 501 | 699838 | 699924 | 700011 | 700098 | 700184 | 700271 | 700358 | 700444 | 700531 | 700617 | 87 |
| 502 | 700704 | 700790 | 700877 | 700963 | 701050 | 701136 | 701222 | 701309 | 701395 | 701482 | 86 |
| 503 | 701568 | 701654 | 701741 | 701827 | 701913 | 701999 | 702086 | 702172 | 702258 | 702344 | 86 |
| 504 | 702431 | 702517 | 702603 | 702689 | 702775 | 702861 | 702947 | 703033 | 703119 | 703205 | 86 |
| 505 | 703291 | 703377 | 703463 | 703549 | 703635 | 703721 | 703807 | 703893 | 703979 | 704065 | 86 |
| 506 | 704151 | 704236 | 704322 | 704408 | 704494 | 704579 | 704665 | 704751 | 704837 | 704922 | 86 |
| 507 | 705008 | 705094 | 705179 | 705265 | 705350 | 705436 | 705522 | 705607 | 705693 | 705778 | 86 |
| 508 | 705864 | 705949 | 706035 | 706120 | 706206 | 706291 | 706376 | 706462 | 706547 | 706632 | 85 |
| 509 | 706718 | 706803 | 706888 | 706974 | 707059 | 707144 | 707229 | 707315 | 707400 | 707485 | 85 |
| 510 | 707570 | 707655 | 707740 | 707826 | 707911 | 707996 | 708081 | 708166 | 708251 | 708336 | 85 |
| 511 | 708421 | 708506 | 708591 | 708676 | 708761 | 708846 | 708931 | 709015 | 709100 | 709185 | 85 |
| 512 | 709270 | 709355 | 709440 | 709524 | 709609 | 709694 | 709779 | 709863 | 709948 | 710033 | 85 |
| 513 | 710117 | 710202 | 710287 | 710371 | 710456 | 710540 | 710625 | 710710 | 710794 | 710879 | 85 |
| 514 | 710963 | 711048 | 711132 | 711217 | 711301 | 711385 | 711470 | 711554 | 711639 | 711723 | 84 |
| 515 | 711807 | 711892 | 711976 | 712060 | 712144 | 712229 | 712313 | 712397 | 712481 | 712566 | 84 |
| 516 | 712650 | 712734 | 712818 | 712902 | 712986 | 713070 | 713154 | 713238 | 713323 | 713407 | 84 |
| 517 | 713491 | 713575 | 713659 | 713742 | 713826 | 713910 | 713994 | 714078 | 714162 | 714246 | 84 |
| 518 | 714330 | 714414 | 714497 | 714581 | 714665 | 714749 | 714833 | 714916 | 715000 | 715084 | 84 |
| 519 | 715167 | 715251 | 715335 | 715418 | 715502 | 715586 | 715669 | 715753 | 715836 | 715920 | 84 |
| 520 | 716003 | 716087 | 716170 | 716254 | 716337 | 716421 | 716504 | 716588 | 716671 | 716754 | 83 |
| 521 | 716838 | 716921 | 717004 | 717088 | 717171 | 717254 | 717338 | 717421 | 717504 | 717587 | 83 |
| 522 | 717671 | 717754 | 717837 | 717920 | 718003 | 718086 | 718169 | 718253 | 718336 | 718419 | 83 |
| 523 | 718502 | 718585 | 718668 | 718751 | 718834 | 718917 | 719000 | 719083 | 719165 | 719248 | 83 |
| 524 | 719331 | 719414 | 719497 | 719580 | 719663 | 719745 | 719828 | 719911 | 719994 | 720077 | 83 |
| 525 | 720159 | 720242 | 720325 | 720407 | 720490 | 720573 | 720655 | 720738 | 720821 | 720903 | 83 |
| 526 | 720986 | 721068 | 721151 | 721233 | 721316 | 721398 | 721481 | 721563 | 721646 | 721728 | 82 |
| 527 | 721811 | 721893 | 721975 | 722058 | 722140 | 722222 | 722305 | 722387 | 722469 | 722552 | 82 |
| 528 | 722634 | 722716 | 722798 | 722881 | 722963 | 723045 | 723127 | 723209 | 723291 | 723374 | 82 |
| 529 | 723456 | 723538 | 723620 | 723702 | 723784 | 723866 | 723948 | 724030 | 724112 | 724194 | 82 |
| 530 | 724276 | 724358 | 724440 | 724522 | 724604 | 724685 | 724767 | 724849 | 724931 | 725013 | 82 |
| 531 | 725095 | 725176 | 725258 | 725340 | 725422 | 725503 | 725585 | 725667 | 725748 | 725830 | 82 |
| 532 | 725912 | 725993 | 726075 | 726156 | 726238 | 726320 | 726401 | 726483 | 726564 | 726646 | 82 |
| 533 | 726727 | 726809 | 726890 | 726972 | 727053 | 727134 | 727216 | 727297 | 727379 | 727460 | 81 |
| 534 | 727541 | 727623 | 727704 | 727785 | 727866 | 727948 | 728029 | 728110 | 728191 | 728273 | 81 |
| 535 | 728354 | 728435 | 728516 | 728597 | 728678 | 728759 | 728841 | 728922 | 729003 | 729084 | 81 |
| 536 | 729165 | 729246 | 729327 | 729408 | 729489 | 729570 | 729651 | 729732 | 729813 | 729893 | 81 |
| 537 | 729974 | 730055 | 730136 | 730217 | 730298 | 730378 | 730459 | 730540 | 730621 | 730702 | 81 |
| 538 | 730782 | 730863 | 730944 | 731024 | 731105 | 731186 | 731266 | 731347 | 731428 | 731508 | 81 |
| 539 | 731589 | 731669 | 731750 | 731830 | 731911 | 731991 | 732072 | 732152 | 732233 | 732313 | 81 |
| 540 | 732394 | 732474 | 732555 | 732635 | 732715 | 732796 | 732876 | 732956 | 733037 | 733117 | 80 |
| 541 | 733197 | 733278 | 733358 | 733438 | 733518 | 733598 | 733679 | 733759 | 733839 | 733919 | 80 |
| 542 | 733999 | 734079 | 734160 | 734240 | 734320 | 734400 | 734480 | 734560 | 734640 | 734720 | 80 |
| 543 | 734800 | 734880 | 734960 | 735040 | 735120 | 735200 | 735279 | 735359 | 735439 | 735519 | 80 |
| 544 | 735599 | 735679 | 735759 | 735838 | 735918 | 735998 | 736078 | 736157 | 736237 | 736317 | 80 |
| 545 | 736397 | 736476 | 736556 | 736635 | 736715 | 736795 | 736874 | 736954 | 737034 | 737113 | 80 |
| 546 | 737193 | 737272 | 737352 | 737431 | 737511 | 737590 | 737670 | 737749 | 737829 | 737908 | 79 |
| 547 | 737987 | 738067 | 738146 | 738225 | 738305 | 738384 | 738463 | 738543 | 738622 | 738701 | 79 |
| 548 | 738781 | 738860 | 738939 | 739018 | 739097 | 739177 | 739256 | 739335 | 739414 | 739493 | 79 |
| 549 | 739572 | 739651 | 739731 | 739810 | 739889 | 739968 | 740047 | 740126 | 740205 | 740284 | 79 |
| 550 | 740363 | 740442 | 740521 | 740600 | 740678 | 740757 | 740836 | 740915 | 740994 | 741073 | 79 |
| 551 | 741152 | 741230 | 741309 | 741388 | 741467 | 741546 | 741624 | 741703 | 741782 | 741860 | 79 |
| 552 | 741939 | 742018 | 742096 | 742175 | 742254 | 742332 | 742411 | 742489 | 742568 | 742647 | 79 |
| 553 | 742725 | 742804 | 742882 | 742961 | 743039 | 743118 | 743196 | 743275 | 743353 | 743431 | 78 |
| 554 | 743510 | 743588 | 743667 | 743745 | 743823 | 743902 | 743980 | 744058 | 744136 | 744215 | 78 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 78 | 8 | 16 | 23 | 31 | 39 | 47 | 55 | 62 | 70 | 83 | 8 | 17 | 25 | 33 | 41 | 50 | 58 | 66 | 75 |
| 79 | 8 | 16 | 24 | 32 | 39 | 47 | 55 | 63 | 71 | 84 | 8 | 17 | 25 | 34 | 42 | 50 | 59 | 67 | 76 |
| 80 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 85 | 8 | 17 | 25 | 34 | 42 | 51 | 59 | 68 | 76 |
| 81 | 8 | 16 | 24 | 32 | 40 | 49 | 57 | 65 | 73 | 86 | 9 | 17 | 26 | 34 | 43 | 52 | 60 | 69 | 77 |
| 82 | 8 | 16 | 25 | 33 | 41 | 49 | 57 | 66 | 74 | 87 | 9 | 17 | 26 | 35 | 43 | 52 | 61 | 70 | 78 |

TABLE XXV.—(*continued*).

**LOGARITHMS OF NUMBERS**

No. 5550 to 6099 Log. 744293 to 785259

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 555 | 744293 | 744371 | 744449 | 744528 | 744606 | 744684 | 744762 | 744840 | 744919 | 744997 | 78 |
| 556 | 745075 | 745153 | 745231 | 745309 | 745387 | 745465 | 745543 | 745621 | 745699 | 745777 | 78 |
| 557 | 745855 | 745933 | 746011 | 746089 | 746167 | 746245 | 746323 | 746401 | 746479 | 746556 | 78 |
| 558 | 746634 | 746712 | 746790 | 746868 | 746945 | 747023 | 747101 | 747179 | 747256 | 747334 | 78 |
| 559 | 747412 | 747489 | 747567 | 747645 | 747722 | 747800 | 747878 | 747955 | 748033 | 748110 | 78 |
| 560 | 748188 | 748266 | 748343 | 748421 | 748498 | 748576 | 748653 | 748731 | 748808 | 748885 | 77 |
| 561 | 748963 | 749040 | 749118 | 749195 | 749272 | 749350 | 749427 | 749504 | 749582 | 749659 | 77 |
| 562 | 749736 | 749814 | 749891 | 749968 | 750045 | 750123 | 750200 | 750277 | 750354 | 750431 | 77 |
| 563 | 750508 | 750586 | 750663 | 750740 | 750817 | 750894 | 750971 | 751048 | 751125 | 751202 | 77 |
| 564 | 751279 | 751356 | 751433 | 751510 | 751587 | 751664 | 751741 | 751818 | 751895 | 751972 | 77 |
| 565 | 752048 | 752125 | 752202 | 752279 | 752356 | 752433 | 752509 | 752586 | 752663 | 752740 | 77 |
| 566 | 752816 | 752893 | 752970 | 753047 | 753123 | 753200 | 753277 | 753353 | 753430 | 753506 | 77 |
| 567 | 753583 | 753660 | 753736 | 753813 | 753889 | 753966 | 754042 | 754119 | 754195 | 754272 | 77 |
| 568 | 754348 | 754425 | 754501 | 754578 | 754654 | 754730 | 754807 | 754883 | 754960 | 755036 | 76 |
| 569 | 755112 | 755189 | 755265 | 755341 | 755417 | 755494 | 755570 | 755646 | 755722 | 755799 | 76 |
| 570 | 755875 | 755951 | 756027 | 756103 | 756180 | 756256 | 756332 | 756408 | 756484 | 756560 | 76 |
| 571 | 756636 | 756712 | 756788 | 756864 | 756940 | 757016 | 757092 | 757168 | 757244 | 757320 | 76 |
| 572 | 757396 | 757472 | 757548 | 757624 | 757700 | 757775 | 757851 | 757927 | 758003 | 758079 | 76 |
| 573 | 758155 | 758230 | 758306 | 758382 | 758458 | 758533 | 758609 | 758685 | 758761 | 758836 | 76 |
| 574 | 758912 | 758988 | 759063 | 759139 | 759214 | 759290 | 759366 | 759441 | 759517 | 759592 | 76 |
| 575 | 759668 | 759743 | 759819 | 759894 | 759970 | 760045 | 760121 | 760196 | 760272 | 760347 | 75 |
| 576 | 760422 | 760498 | 760573 | 760649 | 760724 | 760799 | 760875 | 760950 | 761025 | 761101 | 75 |
| 577 | 761176 | 761251 | 761326 | 761402 | 761477 | 761552 | 761627 | 761702 | 761778 | 761853 | 75 |
| 578 | 761928 | 762003 | 762078 | 762153 | 762228 | 762303 | 762378 | 762453 | 762529 | 762604 | 75 |
| 579 | 762679 | 762754 | 762829 | 762904 | 762978 | 763053 | 763128 | 763203 | 763278 | 763353 | 75 |
| 580 | 763428 | 763503 | 763578 | 763653 | 763727 | 763802 | 763877 | 763952 | 764027 | 764101 | 75 |
| 581 | 764176 | 764251 | 764326 | 764400 | 764475 | 764550 | 764624 | 764699 | 764774 | 764848 | 75 |
| 582 | 764923 | 764998 | 765072 | 765147 | 765221 | 765296 | 765370 | 765445 | 765520 | 765594 | 75 |
| 583 | 765669 | 765743 | 765818 | 765892 | 765966 | 766041 | 766115 | 766190 | 766264 | 766338 | 74 |
| 584 | 766413 | 766487 | 766562 | 766636 | 766710 | 766785 | 766859 | 766933 | 767007 | 767082 | 74 |
| 585 | 767156 | 767230 | 767304 | 767379 | 767453 | 767527 | 767601 | 767675 | 767749 | 767823 | 74 |
| 586 | 767898 | 767972 | 768046 | 768120 | 768194 | 768268 | 768342 | 768416 | 768490 | 768564 | 74 |
| 587 | 768638 | 768712 | 768786 | 768860 | 768934 | 769008 | 769082 | 769156 | 769230 | 769303 | 74 |
| 588 | 769377 | 769451 | 769525 | 769599 | 769673 | 769746 | 769820 | 769894 | 769968 | 770042 | 74 |
| 589 | 770115 | 770189 | 770263 | 770336 | 770410 | 770484 | 770557 | 770631 | 770705 | 770778 | 74 |
| 590 | 770852 | 770926 | 770999 | 771073 | 771146 | 771220 | 771293 | 771367 | 771440 | 771514 | 74 |
| 591 | 771587 | 771661 | 771734 | 771808 | 771881 | 771955 | 772028 | 772102 | 772175 | 772248 | 73 |
| 592 | 772322 | 772395 | 772468 | 772542 | 772615 | 772688 | 772762 | 772835 | 772908 | 772981 | 73 |
| 593 | 773055 | 773128 | 773201 | 773274 | 773348 | 773421 | 773494 | 773567 | 773640 | 773713 | 73 |
| 594 | 773786 | 773860 | 773933 | 774006 | 774079 | 774152 | 774225 | 774298 | 774371 | 774444 | 73 |
| 595 | 774517 | 774590 | 774663 | 774736 | 774809 | 774882 | 774955 | 775028 | 775100 | 775173 | 73 |
| 596 | 775246 | 775319 | 775392 | 775465 | 775538 | 775610 | 775683 | 775756 | 775829 | 775902 | 73 |
| 597 | 775974 | 776047 | 776120 | 776193 | 776265 | 776338 | 776411 | 776483 | 776556 | 776629 | 73 |
| 598 | 776701 | 776774 | 776846 | 776919 | 776992 | 777064 | 777137 | 777209 | 777282 | 777354 | 73 |
| 599 | 777427 | 777499 | 777572 | 777644 | 777717 | 777789 | 777862 | 777934 | 778006 | 778079 | 72 |
| 600 | 778151 | 778224 | 778296 | 778368 | 778441 | 778513 | 778585 | 778658 | 778730 | 778802 | 72 |
| 601 | 778874 | 778947 | 779019 | 779091 | 779163 | 779236 | 779308 | 779380 | 779452 | 779524 | 72 |
| 602 | 779596 | 779669 | 779741 | 779813 | 779885 | 779957 | 780029 | 780101 | 780173 | 780245 | 72 |
| 603 | 780317 | 780389 | 780461 | 780533 | 780605 | 780677 | 780749 | 780821 | 780893 | 780965 | 72 |
| 604 | 781037 | 781109 | 781181 | 781253 | 781324 | 781396 | 781468 | 781540 | 781612 | 781684 | 72 |
| 605 | 781755 | 781827 | 781899 | 781971 | 782042 | 782114 | 782186 | 782258 | 782329 | 782401 | 72 |
| 606 | 782473 | 782544 | 782616 | 782688 | 782759 | 782831 | 782902 | 782974 | 783046 | 783117 | 72 |
| 607 | 783189 | 783260 | 783332 | 783403 | 783475 | 783546 | 783618 | 783689 | 783761 | 783832 | 71 |
| 608 | 783904 | 783975 | 784046 | 784118 | 784189 | 784261 | 784332 | 784403 | 784475 | 784546 | 71 |
| 609 | 784617 | 784689 | 784760 | 784831 | 784902 | 784974 | 785045 | 785116 | 785187 | 785259 | 71 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 71 | 7 | 14 | 21 | 28 | 35 | 43 | 50 | 57 | 64 | 75 | 7 | 15 | 22 | 30 | 37 | 45 | 52 | 60 | 67 |
| 72 | 7 | 14 | 22 | 29 | 36 | 43 | 50 | 58 | 65 | 76 | 8 | 15 | 23 | 30 | 38 | 46 | 53 | 61 | 68 |
| 73 | 7 | 15 | 22 | 29 | 36 | 44 | 51 | 58 | 66 | 77 | 8 | 15 | 23 | 31 | 38 | 46 | 54 | 62 | 69 |
| 74 | 7 | 15 | 22 | 30 | 37 | 44 | 52 | 59 | 67 | 78 | 8 | 16 | 23 | 31 | 39 | 47 | 55 | 62 | 70 |

TABLE XXV.—(*continued*).

**LOGARITHMS OF NUMBERS**

**No. 6100 to 6649** **Log. 785330 to 822756**

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 610 | 785330 | 785401 | 785472 | 785543 | 785615 | 785686 | 785757 | 785828 | 785899 | 785970 | 71 |
| 611 | 786041 | 786112 | 786183 | 786254 | 786325 | 786396 | 786467 | 786538 | 786609 | 786680 | 71 |
| 612 | 786751 | 786822 | 786893 | 786964 | 787035 | 787106 | 787177 | 787248 | 787319 | 787390 | 71 |
| 613 | 787460 | 787531 | 787602 | 787673 | 787744 | 787815 | 787885 | 787956 | 788027 | 788098 | 71 |
| 614 | 788168 | 788239 | 788310 | 788381 | 788451 | 788522 | 788593 | 788663 | 788734 | 788804 | 71 |
| 615 | 788875 | 788946 | 789016 | 789087 | 789157 | 789228 | 789299 | 789369 | 789440 | 789510 | 71 |
| 616 | 789581 | 789651 | 789722 | 789792 | 789863 | 789933 | 790004 | 790074 | 790144 | 790215 | 70 |
| 617 | 790285 | 790356 | 790426 | 790496 | 790567 | 790637 | 790707 | 790778 | 790848 | 790918 | 70 |
| 618 | 790988 | 791059 | 791129 | 791199 | 791269 | 791340 | 791410 | 791480 | 791550 | 791620 | 70 |
| 619 | 791691 | 791761 | 791831 | 791901 | 791971 | 792041 | 792111 | 792181 | 792252 | 792322 | 70 |
| 620 | 792392 | 792462 | 792532 | 792602 | 792672 | 792742 | 792812 | 792882 | 792952 | 793022 | 70 |
| 621 | 793092 | 793162 | 793231 | 793301 | 793371 | 793441 | 793511 | 793581 | 793651 | 793721 | 70 |
| 622 | 793790 | 793860 | 793930 | 794000 | 794070 | 794139 | 794209 | 794279 | 794349 | 794418 | 70 |
| 623 | 794488 | 794558 | 794627 | 794697 | 794767 | 794836 | 794906 | 794976 | 795045 | 795115 | 70 |
| 624 | 795185 | 795254 | 795324 | 795393 | 795463 | 795532 | 795602 | 795672 | 795741 | 795811 | 70 |
| 625 | 795880 | 795949 | 796019 | 796088 | 796158 | 796227 | 796297 | 796366 | 796436 | 796505 | 69 |
| 626 | 796574 | 796644 | 796713 | 796782 | 796852 | 796921 | 796990 | 797060 | 797129 | 797198 | 69 |
| 627 | 797268 | 797337 | 797406 | 797475 | 797545 | 797614 | 797683 | 797752 | 797821 | 797890 | 69 |
| 628 | 797960 | 798029 | 798098 | 798167 | 798236 | 798305 | 798374 | 798443 | 798513 | 798582 | 69 |
| 629 | 798651 | 798720 | 798789 | 798858 | 798927 | 798996 | 799065 | 799134 | 799203 | 799272 | 69 |
| 630 | 799341 | 799409 | 799478 | 799547 | 799616 | 799685 | 799754 | 799823 | 799892 | 799961 | 69 |
| 631 | 800029 | 800098 | 800167 | 800236 | 800305 | 800373 | 800442 | 800511 | 800580 | 800648 | 69 |
| 632 | 800717 | 800786 | 800854 | 800923 | 800992 | 801061 | 801129 | 801198 | 801266 | 801335 | 69 |
| 633 | 801404 | 801472 | 801541 | 801609 | 801678 | 801747 | 801815 | 801884 | 801952 | 802021 | 69 |
| 634 | 802089 | 802158 | 802226 | 802295 | 802363 | 802432 | 802500 | 802568 | 802637 | 802705 | 69 |
| 635 | 802774 | 802842 | 802910 | 802979 | 803047 | 803116 | 803184 | 803252 | 803321 | 803389 | 68 |
| 636 | 803457 | 803525 | 803594 | 803662 | 803730 | 803798 | 803867 | 803935 | 804003 | 804071 | 68 |
| 637 | 804139 | 804208 | 804276 | 804344 | 804412 | 804480 | 804548 | 804616 | 804685 | 804753 | 68 |
| 638 | 804821 | 804889 | 804957 | 805025 | 805093 | 805161 | 805229 | 805297 | 805365 | 805433 | 68 |
| 639 | 805501 | 805569 | 805637 | 805705 | 805773 | 805841 | 805908 | 805976 | 806044 | 806112 | 68 |
| 640 | 806180 | 806248 | 806316 | 806384 | 806451 | 806519 | 806587 | 806655 | 806723 | 806790 | 68 |
| 641 | 806858 | 806926 | 806994 | 807061 | 807129 | 807197 | 807264 | 807332 | 807400 | 807467 | 68 |
| 642 | 807535 | 807603 | 807670 | 807738 | 807806 | 807873 | 807941 | 808008 | 808076 | 808143 | 68 |
| 643 | 808211 | 808279 | 808346 | 808414 | 808481 | 808549 | 808616 | 808684 | 808751 | 808818 | 67 |
| 644 | 808886 | 808953 | 809021 | 809088 | 809156 | 809223 | 809290 | 809358 | 809425 | 809492 | 67 |
| 645 | 809560 | 809627 | 809694 | 809762 | 809829 | 809896 | 809964 | 810031 | 810098 | 810165 | 67 |
| 646 | 810233 | 810300 | 810367 | 810434 | 810501 | 810569 | 810636 | 810703 | 810770 | 810837 | 67 |
| 647 | 810904 | 810971 | 811039 | 811106 | 811173 | 811240 | 811307 | 811374 | 811441 | 811508 | 67 |
| 648 | 811575 | 811642 | 811709 | 811776 | 811843 | 811910 | 811977 | 812044 | 812111 | 812178 | 67 |
| 649 | 812245 | 812312 | 812379 | 812445 | 812512 | 812579 | 812646 | 812713 | 812780 | 812847 | 67 |
| 650 | 812913 | 812980 | 813047 | 813114 | 813181 | 813247 | 813314 | 813381 | 813448 | 813514 | 67 |
| 651 | 813581 | 813648 | 813714 | 813781 | 813848 | 813914 | 813981 | 814048 | 814114 | 814181 | 67 |
| 652 | 814248 | 814314 | 814381 | 814447 | 814514 | 814581 | 814647 | 814714 | 814780 | 814847 | 67 |
| 653 | 814913 | 814980 | 815046 | 815113 | 815179 | 815246 | 815312 | 815378 | 815445 | 815511 | 66 |
| 654 | 815578 | 815644 | 815711 | 815777 | 815843 | 815910 | 815976 | 816042 | 816109 | 816175 | 66 |
| 655 | 816241 | 816308 | 816374 | 816440 | 816506 | 816573 | 816639 | 816705 | 816771 | 816838 | 66 |
| 656 | 816904 | 816970 | 817036 | 817102 | 817169 | 817235 | 817301 | 817367 | 817433 | 817499 | 66 |
| 657 | 817565 | 817631 | 817698 | 817764 | 817830 | 817896 | 817962 | 818028 | 818094 | 818160 | 66 |
| 658 | 818226 | 818292 | 818358 | 818424 | 818490 | 818556 | 818622 | 818688 | 818754 | 818820 | 66 |
| 659 | 818885 | 818951 | 819017 | 819083 | 819149 | 819215 | 819281 | 819346 | 819412 | 819478 | 66 |
| 660 | 819544 | 819610 | 819676 | 819741 | 819807 | 819873 | 819939 | 820004 | 820070 | 820136 | 66 |
| 661 | 820201 | 820267 | 820333 | 820399 | 820464 | 820530 | 820595 | 820661 | 820727 | 820792 | 66 |
| 662 | 820858 | 820924 | 820989 | 821055 | 821120 | 821186 | 821251 | 821317 | 821382 | 821448 | 66 |
| 663 | 821514 | 821579 | 821645 | 821710 | 821775 | 821841 | 821906 | 821972 | 822037 | 822103 | 65 |
| 664 | 822168 | 822233 | 822299 | 822364 | 822430 | 822495 | 822560 | 822626 | 822691 | 822756 | 65 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 65 | 6 | 13 | 19 | 26 | 32 | 39 | 45 | 52 | 58 |
| 66 | 7 | 13 | 20 | 26 | 33 | 40 | 46 | 53 | 59 |
| 67 | 7 | 13 | 29 | 27 | 33 | 40 | 47 | 54 | 60 |
| 68 | 7 | 14 | 20 | 27 | 34 | 41 | 48 | 54 | 61 |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 68 | 7 | 14 | 20 | 27 | 34 | 41 | 48 | 54 | 61 |
| 69 | 7 | 14 | 21 | 28 | 34 | 41 | 48 | 55 | 62 |
| 70 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 |
| 71 | 7 | 4 | 21 | 28 | 35 | 43 | 50 | 57 | 64 |

TABLE XXV.—(*continued*).

**LOGARITHMS OF NUMBERS**

No. 6650 to 7199 | Log. 822822 to 857272

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 665 | 822822 | 822887 | 822952 | 823018 | 823083 | 823148 | 823213 | 823279 | 823344 | 823409 | 65 |
| 666 | 823474 | 823539 | 823605 | 823670 | 823735 | 823800 | 823865 | 823930 | 823996 | 824061 | 65 |
| 667 | 824126 | 824191 | 824256 | 824321 | 824386 | 824451 | 824516 | 824581 | 824646 | 824711 | 65 |
| 668 | 824776 | 824841 | 824906 | 824971 | 825036 | 825101 | 825166 | 825231 | 825296 | 825361 | 65 |
| 669 | 825426 | 825491 | 825556 | 825621 | 825686 | 825751 | 825815 | 825880 | 825945 | 826010 | 65 |
| 670 | 826075 | 826140 | 826204 | 826269 | 826334 | 826399 | 826464 | 826528 | 826593 | 826658 | 65 |
| 671 | 826723 | 826787 | 826852 | 826917 | 826981 | 827046 | 827111 | 827175 | 827240 | 827305 | 65 |
| 672 | 827369 | 827434 | 827499 | 827563 | 827628 | 827692 | 827757 | 827821 | 827886 | 827951 | 65 |
| 673 | 828015 | 828080 | 828144 | 828209 | 828273 | 828338 | 828402 | 828467 | 828531 | 828595 | 64 |
| 674 | 828660 | 828724 | 828789 | 828853 | 828918 | 828982 | 829046 | 829111 | 829175 | 829239 | 64 |
| 675 | 829304 | 829368 | 829432 | 829497 | 829561 | 829625 | 829690 | 829754 | 829818 | 829882 | 64 |
| 676 | 829947 | 830011 | 830075 | 830139 | 830204 | 830268 | 830332 | 830396 | 830460 | 830525 | 64 |
| 677 | 830589 | 830653 | 830717 | 830781 | 830845 | 830909 | 830973 | 831037 | 831102 | 831166 | 64 |
| 678 | 831230 | 831294 | 831358 | 831422 | 831486 | 831550 | 831614 | 831678 | 831742 | 831806 | 64 |
| 679 | 831870 | 831934 | 831998 | 832062 | 832126 | 832189 | 832253 | 832317 | 832381 | 832445 | 64 |
| 680 | 832509 | 832573 | 832637 | 832700 | 832764 | 832828 | 832892 | 832956 | 833020 | 833083 | 64 |
| 681 | 833147 | 833211 | 833275 | 833338 | 833402 | 833466 | 833530 | 833593 | 833657 | 833721 | 64 |
| 682 | 833784 | 833848 | 833912 | 833975 | 834039 | 834103 | 834166 | 834230 | 834294 | 834357 | 64 |
| 683 | 834421 | 834484 | 834548 | 834611 | 834675 | 834739 | 834802 | 834866 | 834929 | 834993 | 64 |
| 684 | 835056 | 835120 | 835183 | 835247 | 835310 | 835373 | 835437 | 835500 | 835564 | 835627 | 63 |
| 685 | 835691 | 835754 | 835817 | 835881 | 835944 | 836007 | 836071 | 836134 | 836197 | 836261 | 63 |
| 686 | 836324 | 836387 | 836451 | 836514 | 836577 | 836641 | 836704 | 836767 | 836830 | 836894 | 63 |
| 687 | 836957 | 837020 | 837083 | 837146 | 837210 | 837273 | 837336 | 837399 | 837462 | 837525 | 63 |
| 688 | 837588 | 837652 | 837715 | 837778 | 837841 | 837904 | 837967 | 838030 | 838093 | 838156 | 63 |
| 689 | 838219 | 838282 | 838345 | 838408 | 838471 | 838534 | 838597 | 838660 | 838723 | 838786 | 63 |
| 690 | 838849 | 838912 | 838975 | 839038 | 839101 | 839164 | 839227 | 839289 | 839352 | 839415 | 63 |
| 691 | 839478 | 839541 | 839604 | 839667 | 839729 | 839792 | 839855 | 839918 | 849981 | 840043 | 63 |
| 692 | 840106 | 840169 | 840232 | 840294 | 840357 | 840420 | 840482 | 840545 | 840608 | 840671 | 63 |
| 693 | 840733 | 840796 | 840859 | 840921 | 840984 | 841046 | 841109 | 841172 | 841234 | 841297 | 63 |
| 694 | 841359 | 841422 | 841485 | 841547 | 841610 | 841672 | 841735 | 841797 | 841860 | 841922 | 63 |
| 695 | 841985 | 842047 | 842110 | 842172 | 842235 | 842297 | 842360 | 842422 | 842484 | 842547 | 62 |
| 696 | 842609 | 842672 | 842734 | 842796 | 842859 | 842921 | 842983 | 843046 | 843108 | 843170 | 62 |
| 697 | 843233 | 843295 | 843357 | 843420 | 843482 | 843544 | 843606 | 843669 | 843731 | 843793 | 62 |
| 698 | 843855 | 843918 | 843980 | 844042 | 844104 | 844166 | 844229 | 844291 | 844353 | 844415 | 62 |
| 699 | 844477 | 844539 | 844601 | 844664 | 844726 | 844788 | 844850 | 844912 | 844974 | 845036 | 62 |
| 700 | 845098 | 845160 | 845222 | 845284 | 845346 | 845408 | 845470 | 845532 | 845594 | 845656 | 62 |
| 701 | 845718 | 845780 | 845842 | 845904 | 845966 | 846028 | 846090 | 846151 | 846213 | 846275 | 62 |
| 702 | 846337 | 846399 | 846461 | 846523 | 846585 | 846646 | 846708 | 846770 | 846832 | 846894 | 62 |
| 703 | 846955 | 847017 | 847079 | 847141 | 847202 | 847264 | 847326 | 847388 | 847449 | 847511 | 62 |
| 704 | 847573 | 847634 | 847696 | 847758 | 847819 | 847881 | 847943 | 848004 | 848066 | 848128 | 62 |
| 705 | 848189 | 848251 | 848312 | 848374 | 848435 | 848497 | 848559 | 848620 | 848682 | 848743 | 62 |
| 706 | 848805 | 848866 | 848928 | 848989 | 849051 | 849112 | 849174 | 849235 | 849297 | 849358 | 61 |
| 707 | 849419 | 849481 | 849542 | 849604 | 849665 | 849726 | 849788 | 849849 | 849911 | 849972 | 61 |
| 708 | 850033 | 850095 | 850156 | 850217 | 850279 | 850340 | 850401 | 850462 | 850524 | 850585 | 61 |
| 709 | 850646 | 850707 | 850769 | 850830 | 850891 | 850952 | 851014 | 851075 | 851136 | 851197 | 61 |
| 710 | 851258 | 851320 | 851381 | 851442 | 851503 | 851564 | 851625 | 851686 | 851747 | 851809 | 61 |
| 711 | 851870 | 851931 | 851992 | 852053 | 852114 | 852175 | 852236 | 852297 | 852358 | 852419 | 61 |
| 712 | 852480 | 852541 | 852602 | 852663 | 852724 | 852785 | 852846 | 852907 | 852968 | 853029 | 61 |
| 713 | 853090 | 853150 | 853211 | 853272 | 853333 | 853394 | 853455 | 853516 | 853577 | 853637 | 61 |
| 714 | 853698 | 853759 | 853820 | 853881 | 853941 | 854002 | 854063 | 854124 | 854185 | 854245 | 61 |
| 715 | 854306 | 854367 | 854428 | 854488 | 854549 | 854610 | 854670 | 854731 | 854792 | 854852 | 61 |
| 716 | 854913 | 854974 | 855034 | 855095 | 855156 | 855216 | 855277 | 855337 | 855398 | 855459 | 61 |
| 717 | 855519 | 855580 | 855640 | 855701 | 855761 | 855822 | 855882 | 855943 | 856003 | 856064 | 61 |
| 718 | 856124 | 856185 | 856245 | 856306 | 856366 | 856427 | 856487 | 856548 | 856608 | 856668 | 60 |
| 719 | 856729 | 856789 | 856850 | 856910 | 856970 | 857031 | 857091 | 857152 | 857212 | 857272 | 60 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 60 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 |
| 61 | 6 | 12 | 18 | 24 | 30 | 37 | 43 | 49 | 55 |
| 62 | 6 | 12 | 19 | 25 | 31 | 37 | 43 | 50 | 56 |

| D | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 63 | 6 | 13 | 19 | 25 | 31 | 38 | 44 | 50 | 57 |
| 64 | 6 | 13 | 19 | 26 | 32 | 38 | 45 | 51 | 58 |
| 65 | 6 | 13 | 19 | 26 | 32 | 39 | 45 | 52 | 58 |

TABLE XXV.—(*continued*).

LOGARITHMS OF NUMBERS

No. 7200 to 7749 Log. 857332 to 889246

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 720 | 857332 | 857393 | 857453 | 857513 | 857574 | 857634 | 857694 | 857755 | 857815 | 857875 | 60 |
| 721 | 857935 | 857995 | 858056 | 858116 | 858176 | 858236 | 858297 | 858357 | 858417 | 858477 | 60 |
| 722 | 858537 | 858597 | 858657 | 858718 | 858778 | 858838 | 858898 | 858958 | 859018 | 859078 | 60 |
| 723 | 859138 | 859198 | 859258 | 859318 | 859379 | 859439 | 859499 | 859559 | 859619 | 859679 | 60 |
| 724 | 859739 | 859799 | 859859 | 859918 | 859978 | 860038 | 860098 | 860158 | 860218 | 860278 | 60 |
| 725 | 860338 | 860398 | 860458 | 860518 | 860578 | 860637 | 860697 | 860757 | 860817 | 860877 | 60 |
| 726 | 860937 | 860996 | 861056 | 861116 | 861176 | 861236 | 861295 | 861355 | 861415 | 861475 | 60 |
| 727 | 861534 | 861594 | 861654 | 861714 | 861773 | 861833 | 861893 | 861952 | 862012 | 862072 | 60 |
| 728 | 862131 | 862191 | 862251 | 862310 | 862370 | 862430 | 862489 | 862549 | 862608 | 862668 | 60 |
| 729 | 862728 | 862787 | 862847 | 862906 | 862966 | 863025 | 863085 | 863144 | 863204 | 863263 | 60 |
| 730 | 863323 | 863382 | 863442 | 863501 | 863561 | 863620 | 863680 | 863739 | 863799 | 863858 | 59 |
| 731 | 863917 | 863977 | 864036 | 864096 | 864155 | 864214 | 864274 | 864333 | 864392 | 864452 | 59 |
| 732 | 864511 | 864570 | 864630 | 864689 | 864748 | 864808 | 864867 | 864926 | 864985 | 865045 | 59 |
| 733 | 865104 | 865163 | 865222 | 865282 | 865341 | 865400 | 865459 | 865519 | 865578 | 865637 | 59 |
| 734 | 865696 | 865755 | 865814 | 865874 | 865933 | 865992 | 866051 | 866110 | 866169 | 866228 | 59 |
| 735 | 866287 | 866346 | 866405 | 866465 | 866524 | 866583 | 866642 | 866701 | 866760 | 866819 | 59 |
| 736 | 866878 | 866937 | 866996 | 867055 | 867114 | 867173 | 867232 | 867291 | 867350 | 867409 | 59 |
| 737 | 867467 | 867526 | 867585 | 867644 | 867703 | 867762 | 867821 | 867880 | 867939 | 867998 | 59 |
| 738 | 868056 | 868115 | 868174 | 868233 | 868292 | 868350 | 868409 | 868468 | 868527 | 868586 | 59 |
| 739 | 868644 | 868703 | 868762 | 868821 | 868879 | 868938 | 868997 | 869056 | 869114 | 869173 | 59 |
| 740 | 869232 | 869290 | 869349 | 869408 | 869466 | 869525 | 869584 | 869642 | 869701 | 869760 | 59 |
| 741 | 869818 | 869877 | 869935 | 869994 | 870053 | 870111 | 870170 | 870228 | 870287 | 870345 | 59 |
| 742 | 870404 | 870462 | 870521 | 870579 | 870638 | 870696 | 870755 | 870813 | 870872 | 870930 | 58 |
| 743 | 870989 | 871047 | 871106 | 871164 | 871223 | 871281 | 871339 | 871398 | 871456 | 871515 | 58 |
| 744 | 871573 | 871631 | 871690 | 871748 | 871806 | 871865 | 871923 | 871981 | 872040 | 872098 | 58 |
| 745 | 872156 | 872215 | 872273 | 872331 | 872389 | 872448 | 872506 | 872564 | 872622 | 872681 | 58 |
| 746 | 872739 | 872797 | 872855 | 872913 | 872972 | 873030 | 873088 | 873146 | 873204 | 873262 | 58 |
| 747 | 873321 | 873379 | 873437 | 873495 | 873553 | 873611 | 873669 | 873727 | 873785 | 873844 | 58 |
| 748 | 873902 | 873960 | 874018 | 874076 | 874134 | 874192 | 874250 | 874308 | 874366 | 874424 | 58 |
| 749 | 874482 | 874540 | 874598 | 874656 | 874714 | 874772 | 874830 | 874888 | 874945 | 875003 | 58 |
| 750 | 875061 | 875119 | 875177 | 875235 | 875293 | 875351 | 875409 | 875466 | 875524 | 875582 | 58 |
| 751 | 875640 | 875698 | 875756 | 875813 | 875871 | 875929 | 875987 | 876045 | 876102 | 876160 | 58 |
| 752 | 876218 | 876276 | 876333 | 876391 | 876449 | 876507 | 876564 | 876622 | 876680 | 876737 | 58 |
| 753 | 876795 | 876853 | 876910 | 876968 | 877026 | 877083 | 877141 | 877199 | 877256 | 877314 | 58 |
| 754 | 877371 | 877429 | 877487 | 877544 | 877602 | 877659 | 877717 | 877774 | 877832 | 877889 | 58 |
| 755 | 877947 | 878004 | 878062 | 878119 | 878177 | 878234 | 878292 | 878349 | 878407 | 878464 | 57 |
| 756 | 878522 | 878579 | 878637 | 878694 | 878752 | 878809 | 878866 | 878924 | 878981 | 879039 | 57 |
| 757 | 879096 | 879153 | 879211 | 879268 | 879325 | 879383 | 879440 | 879497 | 879555 | 879612 | 57 |
| 758 | 879669 | 879726 | 879784 | 879841 | 879898 | 879956 | 880013 | 880070 | 880127 | 880185 | 57 |
| 759 | 880242 | 880299 | 880356 | 880413 | 880471 | 880528 | 880585 | 880642 | 880699 | 880756 | 57 |
| 760 | 880814 | 880871 | 880928 | 880985 | 881042 | 881099 | 881156 | 881213 | 881271 | 881328 | 57 |
| 761 | 881385 | 881442 | 881499 | 881556 | 881613 | 881670 | 881727 | 881784 | 881841 | 881898 | 57 |
| 762 | 881955 | 882012 | 882069 | 882126 | 882183 | 882240 | 882297 | 882354 | 882411 | 882468 | 57 |
| 763 | 882525 | 882581 | 882638 | 882695 | 882752 | 882809 | 882866 | 882923 | 882980 | 883037 | 57 |
| 764 | 883093 | 883150 | 883207 | 883264 | 883321 | 883377 | 883434 | 883491 | 883548 | 883605 | 57 |
| 765 | 883661 | 883718 | 883775 | 883832 | 883888 | 883945 | 884002 | 884059 | 884115 | 884172 | 57 |
| 766 | 884229 | 884285 | 884342 | 884399 | 884455 | 884512 | 884569 | 884625 | 884682 | 884739 | 57 |
| 767 | 884795 | 884852 | 884909 | 884965 | 885022 | 885078 | 885135 | 885192 | 885248 | 885305 | 57 |
| 768 | 885361 | 885418 | 885474 | 885531 | 885587 | 885644 | 885700 | 885757 | 885813 | 885870 | 57 |
| 769 | 885926 | 885983 | 886039 | 886096 | 886152 | 886200 | 886265 | 886321 | 886378 | 886434 | 56 |
| 770 | 886491 | 886547 | 886604 | 886660 | 886716 | 886773 | 886829 | 886885 | 886942 | 886998 | 56 |
| 771 | 887054 | 887111 | 887167 | 887223 | 887280 | 887336 | 887392 | 887449 | 887505 | 887561 | 56 |
| 772 | 887617 | 887674 | 887730 | 887786 | 887842 | 887898 | 887955 | 888011 | 888067 | 888123 | 56 |
| 773 | 888179 | 888236 | 888292 | 888348 | 888404 | 888460 | 888516 | 888573 | 888629 | 888685 | 56 |
| 774 | 888741 | 888797 | 888853 | 888909 | 888965 | 889021 | 889077 | 889134 | 889190 | 889246 | 56 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 56 | 6 | 11 | 17 | 22 | 28 | 34 | 39 | 45 | 50 |
| 57 | 6 | 11 | 17 | 23 | 28 | 34 | 40 | 46 | 51 |
| 58 | 6 | 12 | 17 | 23 | 29 | 35 | 41 | 46 | 52 |
| 59 | 6 | 12 | 18 | 24 | 29 | 35 | 41 | 47 | 53 |
| 60 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 |

TABLE XXV.—(*continued*).

### LOGARITHMS OF NUMBERS

No. 7750 to 8299 Log. 889302 to 919026

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 775 | 889302 | 889358 | 889414 | 889470 | 889526 | 889582 | 889638 | 889694 | 889750 | 889806 | 56 |
| 776 | 889862 | 889918 | 889974 | 890030 | 890086 | 890141 | 890197 | 890253 | 890309 | 890365 | 56 |
| 777 | 890421 | 890477 | 890533 | 890589 | 890645 | 890700 | 890756 | 890812 | 890868 | 890924 | 56 |
| 778 | 890980 | 891035 | 891091 | 891147 | 891203 | 891259 | 891314 | 891370 | 891426 | 891482 | 56 |
| 779 | 891537 | 891593 | 891649 | 891705 | 891760 | 891816 | 891872 | 891928 | 891983 | 892039 | 56 |
| 780 | 892095 | 892150 | 892206 | 892262 | 892317 | 892373 | 892429 | 892484 | 892540 | 892595 | 56 |
| 781 | 892651 | 892707 | 892762 | 892818 | 892873 | 892929 | 892985 | 893040 | 893096 | 893151 | 56 |
| 782 | 893207 | 893262 | 893318 | 893373 | 893429 | 893484 | 893540 | 893595 | 893651 | 893706 | 56 |
| 783 | 893762 | 893817 | 893873 | 893928 | 893984 | 894039 | 894094 | 894150 | 894205 | 894261 | 55 |
| 784 | 894316 | 894371 | 894427 | 894482 | 894538 | 894593 | 894648 | 894704 | 894759 | 894814 | 55 |
| 785 | 894870 | 894925 | 894980 | 895036 | 895091 | 895146 | 895201 | 895257 | 895312 | 895367 | 55 |
| 786 | 895423 | 895478 | 895533 | 895588 | 895644 | 895699 | 895754 | 895809 | 895864 | 895920 | 55 |
| 787 | 895975 | 896030 | 896085 | 896140 | 896195 | 896251 | 896306 | 896361 | 896416 | 896471 | 55 |
| 788 | 896526 | 896581 | 896636 | 896692 | 896747 | 896802 | 896857 | 896912 | 896967 | 897022 | 55 |
| 789 | 897077 | 897132 | 897187 | 897242 | 897297 | 897352 | 897407 | 897462 | 897517 | 897572 | 55 |
| 790 | 897627 | 897682 | 897737 | 897792 | 897847 | 897902 | 897957 | 898012 | 898067 | 898122 | 55 |
| 791 | 898176 | 898231 | 898286 | 898341 | 898396 | 898451 | 898506 | 898561 | 898615 | 898670 | 55 |
| 792 | 898725 | 898780 | 898835 | 898890 | 898944 | 898999 | 899054 | 899109 | 899164 | 899218 | 55 |
| 793 | 899273 | 899328 | 899383 | 899437 | 899492 | 899547 | 899602 | 899656 | 899711 | 899766 | 55 |
| 794 | 899821 | 899875 | 899930 | 899985 | 900039 | 900094 | 900149 | 900203 | 900258 | 900312 | 55 |
| 795 | 900367 | 900422 | 900476 | 900531 | 900586 | 900640 | 900695 | 900749 | 900804 | 900859 | 55 |
| 796 | 900913 | 900968 | 901022 | 901077 | 901131 | 901186 | 901240 | 901295 | 901349 | 901404 | 55 |
| 797 | 901458 | 901513 | 901567 | 901622 | 901676 | 901731 | 901785 | 901840 | 901894 | 901948 | 54 |
| 798 | 902003 | 902057 | 902112 | 902166 | 902221 | 902275 | 902329 | 902384 | 902438 | 902492 | 54 |
| 799 | 902547 | 902601 | 902655 | 902710 | 902764 | 902818 | 902873 | 902927 | 902981 | 903036 | 54 |
| 800 | 903090 | 903144 | 903199 | 903253 | 903307 | 903361 | 903416 | 903470 | 903524 | 903578 | 54 |
| 801 | 903633 | 903687 | 903741 | 903795 | 903849 | 903904 | 903958 | 904012 | 904066 | 904120 | 54 |
| 802 | 904174 | 904229 | 904283 | 904337 | 904391 | 904445 | 904499 | 904553 | 904607 | 904661 | 54 |
| 803 | 904716 | 904770 | 904824 | 904878 | 904932 | 904986 | 905040 | 905094 | 905148 | 905202 | 54 |
| 804 | 905256 | 905310 | 905364 | 905418 | 905472 | 905526 | 905580 | 905634 | 905688 | 905742 | 54 |
| 805 | 905796 | 905850 | 905904 | 905958 | 906012 | 906066 | 906119 | 906173 | 906227 | 906281 | 54 |
| 806 | 906335 | 906389 | 906443 | 906497 | 906551 | 906604 | 906658 | 906712 | 906766 | 906820 | 54 |
| 807 | 906874 | 906927 | 906981 | 907035 | 907089 | 907143 | 907196 | 907250 | 907304 | 907358 | 54 |
| 808 | 907411 | 907465 | 907519 | 907573 | 907626 | 907680 | 907734 | 907787 | 907841 | 907895 | 54 |
| 809 | 907949 | 908002 | 908056 | 908110 | 908163 | 908217 | 908270 | 908324 | 908378 | 908431 | 54 |
| 810 | 908485 | 908539 | 908592 | 908646 | 908699 | 908753 | 908807 | 908860 | 908914 | 908967 | 54 |
| 811 | 909021 | 909074 | 909128 | 909181 | 909235 | 909289 | 909342 | 909396 | 909449 | 909503 | 54 |
| 812 | 909556 | 909610 | 909663 | 909716 | 909770 | 909823 | 909877 | 909930 | 909984 | 910037 | 53 |
| 813 | 910091 | 910144 | 910197 | 910251 | 910304 | 910358 | 910411 | 910464 | 910518 | 910571 | 53 |
| 814 | 910624 | 910678 | 910731 | 910784 | 910838 | 910891 | 910944 | 910998 | 911051 | 911104 | 53 |
| 815 | 911158 | 911211 | 911264 | 911317 | 911371 | 911424 | 911477 | 911530 | 911584 | 911637 | 53 |
| 816 | 911690 | 911743 | 911797 | 911850 | 911903 | 911956 | 912009 | 912063 | 912116 | 912169 | 53 |
| 817 | 912222 | 912275 | 912328 | 912381 | 912435 | 912488 | 912541 | 912594 | 912647 | 912700 | 53 |
| 818 | 912753 | 912806 | 912859 | 912913 | 912966 | 913019 | 913072 | 913125 | 913178 | 913231 | 53 |
| 819 | 913284 | 913337 | 913390 | 913443 | 913496 | 913549 | 913602 | 913655 | 913708 | 913761 | 53 |
| 820 | 913814 | 913867 | 913920 | 913973 | 914026 | 914079 | 914132 | 914184 | 914237 | 914290 | 53 |
| 821 | 914343 | 914396 | 914449 | 914502 | 914555 | 914608 | 914660 | 914713 | 914766 | 914819 | 53 |
| 822 | 914872 | 914925 | 914977 | 915030 | 915083 | 915136 | 915189 | 915241 | 915294 | 915347 | 53 |
| 923 | 915400 | 915453 | 915505 | 915558 | 915611 | 915664 | 915716 | 915769 | 915822 | 915875 | 53 |
| 824 | 915927 | 915980 | 916033 | 916085 | 916138 | 916191 | 916243 | 916296 | 916349 | 916401 | 53 |
| 825 | 916454 | 916507 | 916559 | 916612 | 916664 | 916717 | 916770 | 916822 | 916875 | 916927 | 53 |
| 826 | 916980 | 917033 | 917085 | 917138 | 917190 | 917243 | 917295 | 917348 | 917400 | 917453 | 53 |
| 827 | 917506 | 917558 | 917611 | 917663 | 917716 | 917768 | 917820 | 917873 | 917925 | 917978 | 52 |
| 828 | 918030 | 918083 | 918135 | 918188 | 918240 | 918293 | 918345 | 918397 | 918450 | 918502 | 52 |
| 829 | 918555 | 918607 | 918659 | 918712 | 918764 | 918816 | 918869 | 918921 | 918973 | 919026 | 52 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 52 | 5 | 10 | 16 | 21 | 26 | 31 | 36 | 42 | 47 |
| 53 | 5 | 11 | 16 | 21 | 26 | 32 | 37 | 42 | 48 |
| 54 | 5 | 11 | 16 | 22 | 27 | 32 | 38 | 43 | 49 |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 55 | 5 | 11 | 16 | 22 | 27 | 33 | 38 | 44 | 49 |
| 56 | 6 | 11 | 17 | 22 | 28 | 34 | 39 | 45 | 50 |

TABLE XXV.—(*continued*).

**LOGARITHMS OF NUMBERS**

No. 8300 to 8849 Log. 919078 to 946894

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 830 | 919078 | 919130 | 919183 | 919235 | 919287 | 919340 | 919392 | 919444 | 919496 | 919549 | 52 |
| 831 | 919601 | 919653 | 919706 | 919758 | 919810 | 919862 | 919914 | 919967 | 920019 | 920071 | 52 |
| 832 | 920123 | 920176 | 920228 | 920280 | 920332 | 920384 | 920436 | 920489 | 920541 | 920593 | 52 |
| 833 | 920645 | 920697 | 920749 | 920801 | 920853 | 920906 | 920958 | 921010 | 921062 | 921114 | 52 |
| 834 | 921166 | 921218 | 921270 | 921322 | 921374 | 921426 | 921478 | 921530 | 921582 | 921634 | 52 |
| 835 | 921686 | 921738 | 921790 | 921842 | 921894 | 921946 | 921998 | 922050 | 922102 | 922154 | 52 |
| 836 | 922206 | 922258 | 922310 | 922362 | 922414 | 922466 | 922518 | 922570 | 922622 | 922674 | 52 |
| 837 | 922725 | 922777 | 922829 | 922881 | 922933 | 922985 | 923037 | 923089 | 923140 | 923192 | 52 |
| 838 | 923244 | 923296 | 923348 | 923399 | 923451 | 923503 | 923555 | 923607 | 923658 | 923710 | 52 |
| 839 | 923702 | 923814 | 923865 | 923917 | 923969 | 924021 | 924072 | 924124 | 924176 | 924228 | 52 |
| 840 | 924279 | 924331 | 924383 | 924434 | 924486 | 924538 | 924589 | 924641 | 924693 | 924744 | 52 |
| 841 | 924796 | 924848 | 924899 | 924951 | 925003 | 925054 | 925106 | 925157 | 925209 | 925261 | 52 |
| 842 | 925312 | 925364 | 925415 | 925467 | 925518 | 925570 | 925621 | 925673 | 925725 | 925776 | 52 |
| 843 | 925828 | 925879 | 925931 | 925982 | 926034 | 926085 | 926137 | 926188 | 926240 | 926291 | 51 |
| 844 | 926342 | 926394 | 926445 | 926497 | 926548 | 926600 | 926651 | 926702 | 926754 | 926805 | 51 |
| 845 | 926857 | 926908 | 926959 | 927011 | 927062 | 927114 | 927165 | 927216 | 927268 | 927319 | 51 |
| 846 | 927370 | 927422 | 927473 | 927524 | 927576 | 927627 | 927678 | 927730 | 927781 | 927832 | 51 |
| 847 | 927883 | 927935 | 927986 | 928037 | 928088 | 928140 | 928191 | 928242 | 928293 | 928345 | 51 |
| 848 | 928396 | 928447 | 928498 | 928549 | 928601 | 928652 | 928703 | 928754 | 928805 | 928857 | 51 |
| 849 | 928908 | 928959 | 929010 | 929061 | 929112 | 929163 | 929215 | 929266 | 929317 | 929368 | 51 |
| 850 | 929419 | 929470 | 929521 | 929572 | 929623 | 929674 | 929725 | 929776 | 929827 | 929879 | 51 |
| 851 | 929930 | 929981 | 930032 | 930083 | 930134 | 930185 | 930236 | 930287 | 930338 | 930389 | 51 |
| 852 | 930440 | 930491 | 930542 | 930592 | 930643 | 930694 | 930745 | 930796 | 930847 | 930898 | 51 |
| 853 | 930949 | 931000 | 931051 | 931102 | 931153 | 931203 | 931254 | 931305 | 931356 | 931407 | 51 |
| 854 | 931458 | 931509 | 931560 | 931610 | 931661 | 931712 | 931763 | 931814 | 931865 | 931915 | 51 |
| 855 | 931966 | 932017 | 932068 | 932118 | 932169 | 932220 | 932271 | 932322 | 932372 | 932423 | 51 |
| 856 | 932474 | 932524 | 932575 | 932626 | 932677 | 932727 | 932778 | 932829 | 932879 | 932930 | 51 |
| 857 | 932981 | 933031 | 933082 | 933133 | 933183 | 933234 | 933285 | 933335 | 933386 | 933437 | 51 |
| 858 | 933487 | 933538 | 933589 | 933639 | 933690 | 933740 | 933791 | 933841 | 933892 | 933943 | 51 |
| 859 | 933993 | 934044 | 934094 | 934145 | 934195 | 934246 | 934296 | 934347 | 934397 | 934448 | 51 |
| 860 | 934498 | 934549 | 934599 | 934650 | 934700 | 934751 | 934801 | 934852 | 934902 | 934953 | 50 |
| 861 | 935003 | 935054 | 935104 | 935154 | 935205 | 935255 | 935306 | 935356 | 935406 | 935457 | 50 |
| 862 | 935507 | 935558 | 935608 | 935658 | 935709 | 935759 | 935809 | 935860 | 935910 | 935960 | 50 |
| 863 | 936011 | 936061 | 936111 | 936162 | 936212 | 936262 | 936313 | 936363 | 936413 | 936463 | 50 |
| 864 | 936514 | 936564 | 936614 | 936665 | 936715 | 936765 | 936815 | 936865 | 936916 | 936966 | 50 |
| 865 | 937016 | 937066 | 937117 | 937167 | 937217 | 937267 | 937317 | 937367 | 937418 | 937468 | 50 |
| 866 | 937518 | 937568 | 937618 | 937668 | 937718 | 937769 | 937819 | 937869 | 937919 | 937969 | 50 |
| 867 | 938019 | 938069 | 938119 | 938169 | 938219 | 938269 | 938319 | 938370 | 938420 | 938470 | 50 |
| 868 | 938520 | 938570 | 938620 | 938670 | 938720 | 938770 | 938820 | 938870 | 938920 | 938970 | 50 |
| 869 | 939020 | 939070 | 939120 | 939170 | 939220 | 939270 | 939320 | 939369 | 939419 | 939469 | 50 |
| 870 | 939519 | 939569 | 939619 | 939669 | 939719 | 939769 | 939819 | 939869 | 939918 | 939968 | 50 |
| 871 | 940018 | 940068 | 940118 | 940168 | 940218 | 940267 | 940317 | 940367 | 940417 | 940467 | 50 |
| 872 | 940516 | 940566 | 940616 | 940666 | 940716 | 940765 | 940815 | 940865 | 940915 | 940964 | 50 |
| 873 | 941014 | 941064 | 941114 | 941163 | 941213 | 941263 | 941313 | 941362 | 941412 | 941462 | 50 |
| 874 | 941511 | 941561 | 941611 | 941660 | 941710 | 941760 | 941809 | 941859 | 941909 | 941958 | 50 |
| 875 | 942008 | 942058 | 942107 | 942157 | 942207 | 942256 | 942306 | 942355 | 942405 | 942455 | 50 |
| 876 | 942504 | 942554 | 942603 | 942653 | 942702 | 942752 | 942801 | 942851 | 942901 | 942950 | 50 |
| 877 | 943000 | 943049 | 943099 | 943148 | 943198 | 943247 | 943297 | 943346 | 943396 | 943445 | 49 |
| 878 | 943495 | 943544 | 943593 | 943643 | 943692 | 943742 | 943791 | 943841 | 943890 | 943939 | 49 |
| 879 | 943989 | 944038 | 944088 | 944137 | 944186 | 944236 | 944285 | 944335 | 944384 | 944433 | 49 |
| 880 | 944483 | 944532 | 944581 | 944631 | 944680 | 944729 | 944779 | 944828 | 944877 | 944927 | 49 |
| 881 | 944976 | 945025 | 945074 | 945124 | 945173 | 945222 | 945272 | 945321 | 945370 | 945419 | 49 |
| 882 | 945469 | 945518 | 945567 | 945616 | 945665 | 945715 | 945764 | 945813 | 945862 | 945912 | 49 |
| 883 | 945961 | 946010 | 946059 | 946108 | 946157 | 946207 | 946256 | 946305 | 946354 | 946403 | 49 |
| 884 | 946452 | 946501 | 946551 | 946600 | 946649 | 946698 | 946747 | 946796 | 946845 | 946894 | 49 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 49 | 5 | 10 | 15 | 20 | 24 | 29 | 34 | 39 | 44 |
| 50 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 51 | 5 | 10 | 15 | 20 | 25 | 31 | 36 | 41 | 46 |
| 52 | 5 | 10 | 16 | 21 | 26 | 31 | 36 | 42 | 47 |

TABLE XXV.—(*continued*).

LOGARITHMS OF NUMBERS

No. 8850 to 9419 Log. 946943 to 974005

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 885 | 946943 | 946992 | 947041 | 947090 | 947140 | 947189 | 947238 | 947287 | 947336 | 947385 | 49 |
| 886 | 947434 | 947483 | 947532 | 947581 | 947630 | 947679 | 947728 | 947777 | 947826 | 947875 | 49 |
| 887 | 947924 | 947973 | 948022 | 948070 | 948119 | 948168 | 948217 | 948266 | 948315 | 948364 | 49 |
| 888 | 948413 | 948462 | 948511 | 948560 | 948609 | 948657 | 948706 | 948755 | 948804 | 948853 | 49 |
| 889 | 948902 | 948951 | 948999 | 949048 | 949097 | 949146 | 949195 | 949244 | 949292 | 949341 | 49 |
| 890 | 949390 | 949439 | 949488 | 949536 | 949585 | 949634 | 949683 | 949731 | 949780 | 949829 | 49 |
| 891 | 949878 | 949926 | 949975 | 950024 | 950073 | 950121 | 950170 | 950219 | 950267 | 950316 | 49 |
| 892 | 950365 | 950414 | 950462 | 950511 | 950560 | 950608 | 950657 | 950706 | 950754 | 950803 | 49 |
| 893 | 950851 | 950900 | 950949 | 950997 | 951046 | 951095 | 951143 | 951192 | 951240 | 951289 | 49 |
| 894 | 951338 | 951386 | 951435 | 951483 | 951532 | 951580 | 951629 | 951677 | 951726 | 951775 | 49 |
| 895 | 951823 | 951872 | 951920 | 951969 | 952017 | 952066 | 952114 | 952163 | 952211 | 952260 | 48 |
| 896 | 952308 | 952356 | 952405 | 952453 | 952502 | 952550 | 952599 | 952647 | 952696 | 952744 | 48 |
| 897 | 952792 | 952841 | 952889 | 952938 | 952986 | 953034 | 953083 | 953131 | 953180 | 953228 | 48 |
| 898 | 953276 | 953325 | 953373 | 953421 | 953470 | 953518 | 953566 | 953615 | 953663 | 953711 | 48 |
| 899 | 953760 | 953808 | 953856 | 953905 | 953953 | 954001 | 954049 | 954098 | 954146 | 954194 | 48 |
| 900 | 954243 | 954291 | 954339 | 954387 | 954435 | 954484 | 954532 | 954580 | 954628 | 954677 | 48 |
| 901 | 954725 | 954773 | 954821 | 954869 | 954918 | 954966 | 955014 | 955062 | 955110 | 955158 | 48 |
| 902 | 955207 | 955255 | 955303 | 955351 | 955399 | 955447 | 955495 | 955543 | 955592 | 955640 | 48 |
| 903 | 955688 | 955736 | 955784 | 955832 | 955880 | 955928 | 955976 | 956024 | 956072 | 956120 | 48 |
| 904 | 956168 | 956216 | 956265 | 956313 | 956361 | 956409 | 956457 | 956505 | 956553 | 956601 | 48 |
| 905 | 956649 | 956697 | 956745 | 956793 | 956840 | 956888 | 956936 | 956984 | 957032 | 957080 | 48 |
| 906 | 957128 | 957176 | 957224 | 957272 | 957320 | 957368 | 957416 | 957464 | 957512 | 957559 | 48 |
| 907 | 957607 | 957655 | 957703 | 957751 | 957799 | 957847 | 957894 | 957942 | 957990 | 958038 | 48 |
| 908 | 958086 | 958134 | 958181 | 958229 | 958277 | 958325 | 958373 | 958421 | 958468 | 958516 | 48 |
| 909 | 958564 | 958612 | 958659 | 958707 | 958755 | 958803 | 958850 | 958898 | 958946 | 958994 | 48 |
| 910 | 959041 | 959089 | 959137 | 959185 | 959232 | 959280 | 959328 | 959375 | 959423 | 959471 | 48 |
| 911 | 959518 | 959566 | 959614 | 959661 | 959709 | 959757 | 959804 | 959852 | 959900 | 959947 | 48 |
| 912 | 959995 | 960042 | 960090 | 960138 | 960185 | 960233 | 960280 | 960328 | 960376 | 960423 | 48 |
| 913 | 960471 | 960518 | 960566 | 960613 | 960661 | 960709 | 960756 | 960804 | 960851 | 960899 | 48 |
| 914 | 960946 | 960994 | 961041 | 961089 | 961136 | 961184 | 961231 | 961279 | 961326 | 961374 | 47 |
| 915 | 961421 | 961469 | 961516 | 961563 | 961611 | 961658 | 961706 | 961753 | 961801 | 961848 | 47 |
| 916 | 961895 | 961943 | 961990 | 962038 | 962085 | 962132 | 962180 | 962227 | 962275 | 962322 | 47 |
| 917 | 962369 | 962417 | 962464 | 962511 | 962559 | 962606 | 962653 | 962701 | 962748 | 962795 | 47 |
| 918 | 962843 | 962890 | 962937 | 962985 | 963032 | 963079 | 963126 | 963174 | 963221 | 963268 | 47 |
| 919 | 963316 | 963363 | 963410 | 963457 | 963504 | 963552 | 963599 | 963646 | 963693 | 963741 | 47 |
| 920 | 963788 | 963835 | 963882 | 963929 | 963977 | 964024 | 964071 | 964118 | 964165 | 964212 | 47 |
| 921 | 964260 | 964307 | 964354 | 964401 | 964448 | 964495 | 964542 | 964590 | 964637 | 964684 | 47 |
| 922 | 964731 | 964778 | 964825 | 964872 | 964919 | 964966 | 965013 | 965061 | 965108 | 965155 | 47 |
| 923 | 965202 | 965249 | 965296 | 965343 | 965390 | 965437 | 965484 | 965531 | 965578 | 965625 | 47 |
| 924 | 965672 | 965719 | 965766 | 965813 | 965860 | 965907 | 965954 | 966001 | 966048 | 966095 | 47 |
| 925 | 966142 | 566189 | 966236 | 966283 | 966329 | 966376 | 966423 | 966470 | 966517 | 966564 | 47 |
| 926 | 966611 | 966658 | 966705 | 966752 | 966799 | 966845 | 966892 | 966939 | 966986 | 967033 | 47 |
| 927 | 967080 | 967127 | 967173 | 967220 | 967267 | 967314 | 967361 | 967408 | 967454 | 967501 | 47 |
| 928 | 967548 | 967595 | 967642 | 967688 | 967735 | 967782 | 967829 | 967875 | 967922 | 967969 | 47 |
| 929 | 968016 | 968062 | 968109 | 968156 | 968203 | 968249 | 968296 | 968343 | 968390 | 968436 | 47 |
| 930 | 968483 | 968530 | 968576 | 968623 | 968670 | 968716 | 968763 | 968810 | 968856 | 968903 | 47 |
| 931 | 968950 | 968996 | 969043 | 969090 | 969136 | 969183 | 969229 | 969276 | 969323 | 969369 | 47 |
| 932 | 969416 | 969463 | 969509 | 969556 | 969602 | 969649 | 969695 | 969742 | 969789 | 969835 | 47 |
| 933 | 969882 | 969928 | 969975 | 970021 | 970068 | 970114 | 970161 | 970207 | 970254 | 970300 | 47 |
| 934 | 970347 | 970393 | 970440 | 970486 | 970533 | 970579 | 970626 | 970672 | 970719 | 970765 | 46 |
| 935 | 970812 | 970858 | 970904 | 970951 | 970997 | 971044 | 971090 | 971137 | 971183 | 971229 | 46 |
| 936 | 971276 | 971322 | 971369 | 971415 | 971461 | 971508 | 971554 | 971601 | 971647 | 971693 | 46 |
| 937 | 971740 | 971786 | 971832 | 971879 | 971925 | 971971 | 972018 | 972064 | 972110 | 972157 | 46 |
| 938 | 972203 | 972249 | 972295 | 972342 | 972388 | 972434 | 972481 | 972527 | 972573 | 972619 | 46 |
| 939 | 972666 | 972712 | 972758 | 972804 | 972851 | 972897 | 972943 | 972989 | 973035 | 973082 | 46 |
| 940 | 973128 | 973174 | 973220 | 973266 | 973313 | 973359 | 973405 | 973451 | 973497 | 973543 | 46 |
| 941 | 973590 | 973636 | 973682 | 973728 | 973774 | 973820 | 973866 | 973913 | 973959 | 974005 | 46 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46 | 5 | 9 | 14 | 18 | 23 | 28 | 32 | 37 | 41 | 48 | 5 | 10 | 14 | 19 | 24 | 29 | 34 | 38 | 43 |
| 47 | 5 | 9 | 14 | 19 | 23 | 28 | 33 | 38 | 42 | 49 | 5 | 10 | 15 | 20 | 24 | 29 | 34 | 39 | 44 |

## TABLE XXV.—(*continued*).

### LOGARITHMS OF NUMBERS

No. 9420 to 9999 Log. 974051 to 999957

| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 942 | 974051 | 974097 | 974143 | 974189 | 974235 | 974281 | 974327 | 974374 | 974420 | 974466 | 46 |
| 943 | 974512 | 974558 | 974604 | 974650 | 974696 | 974742 | 974788 | 974834 | 974880 | 974926 | 46 |
| 944 | 974972 | 975018 | 975064 | 975110 | 975156 | 975202 | 975248 | 975294 | 975340 | 975386 | 46 |
| 945 | 975432 | 975478 | 975524 | 975570 | 975616 | 975662 | 975707 | 975753 | 975799 | 975845 | 46 |
| 946 | 975891 | 975937 | 975983 | 976029 | 976075 | 976121 | 976167 | 976212 | 976258 | 976304 | 46 |
| 947 | 976350 | 976396 | 976442 | 976488 | 976533 | 976579 | 976625 | 976671 | 976717 | 976763 | 46 |
| 948 | 976808 | 976854 | 976900 | 976946 | 976992 | 977037 | 977083 | 977129 | 977175 | 977220 | 46 |
| 949 | 977266 | 977312 | 977358 | 977403 | 977449 | 977495 | 977541 | 977586 | 977632 | 977678 | 46 |
| 950 | 977724 | 977769 | 977815 | 977861 | 977906 | 977952 | 977998 | 978043 | 978089 | 978135 | 46 |
| 951 | 978181 | 978226 | 978272 | 978317 | 978363 | 978409 | 978454 | 978500 | 978546 | 978591 | 46 |
| 952 | 978637 | 978683 | 978728 | 978774 | 978819 | 978865 | 978911 | 978956 | 979002 | 979047 | 46 |
| 953 | 979093 | 979138 | 979184 | 979230 | 979275 | 979321 | 979366 | 979412 | 979457 | 979503 | 46 |
| 954 | 979548 | 979594 | 979639 | 979685 | 979730 | 979776 | 979821 | 979867 | 979912 | 979958 | 46 |
| 955 | 980003 | 980049 | 980094 | 980140 | 980185 | 980231 | 980276 | 980322 | 980367 | 980412 | 45 |
| 956 | 980458 | 980503 | 980549 | 980594 | 980640 | 980685 | 980730 | 980776 | 980821 | 980867 | 45 |
| 957 | 980912 | 980957 | 981003 | 981048 | 981093 | 981139 | 981184 | 981229 | 981275 | 981320 | 45 |
| 958 | 981366 | 981411 | 981456 | 981501 | 981547 | 981592 | 981637 | 981683 | 981728 | 981773 | 45 |
| 959 | 981819 | 981864 | 981909 | 981954 | 982000 | 982045 | 982090 | 982135 | 982181 | 982226 | 45 |
| 960 | 982271 | 982316 | 982362 | 982407 | 982452 | 982497 | 982543 | 982588 | 982633 | 982678 | 45 |
| 961 | 982723 | 982769 | 982814 | 982859 | 982904 | 982949 | 982994 | 983040 | 983085 | 983130 | 45 |
| 962 | 983175 | 983220 | 983265 | 983310 | 983356 | 983401 | 983446 | 983491 | 983536 | 983581 | 45 |
| 963 | 983626 | 983671 | 983716 | 983762 | 983807 | 983852 | 983897 | 983942 | 983987 | 984032 | 45 |
| 964 | 984077 | 984122 | 984167 | 984212 | 984257 | 984302 | 984347 | 984392 | 984437 | 984482 | 45 |
| 965 | 984527 | 984572 | 984617 | 984662 | 984707 | 984752 | 984797 | 984842 | 984887 | 984932 | 45 |
| 966 | 984977 | 985022 | 985067 | 985112 | 985157 | 985202 | 985247 | 985292 | 985337 | 985382 | 45 |
| 967 | 985426 | 985471 | 985516 | 985561 | 985606 | 985651 | 985696 | 985741 | 985786 | 985830 | 45 |
| 968 | 985875 | 985920 | 985965 | 986010 | 986055 | 986100 | 986144 | 986189 | 986234 | 986279 | 45 |
| 969 | 986324 | 986369 | 986413 | 986458 | 986503 | 986548 | 986593 | 986637 | 986682 | 986727 | 45 |
| 970 | 986772 | 986817 | 986861 | 986906 | 986951 | 986996 | 987040 | 987085 | 987130 | 987175 | 45 |
| 971 | 987219 | 987264 | 987309 | 987353 | 987398 | 987443 | 987488 | 987532 | 987577 | 987622 | 45 |
| 972 | 987666 | 987711 | 987756 | 987800 | 987845 | 987890 | 987934 | 987979 | 988024 | 988068 | 45 |
| 973 | 988113 | 988157 | 988202 | 988247 | 988291 | 988336 | 988381 | 988425 | 988470 | 988514 | 45 |
| 974 | 988559 | 988604 | 988648 | 988693 | 988737 | 988782 | 988826 | 988871 | 988916 | 988960 | 45 |
| 975 | 989005 | 989049 | 989094 | 989138 | 989183 | 989227 | 989272 | 989316 | 989361 | 989405 | 45 |
| 976 | 989450 | 989494 | 989539 | 989583 | 989628 | 989672 | 989717 | 989761 | 989806 | 989850 | 44 |
| 977 | 989895 | 989939 | 989983 | 990028 | 990072 | 990117 | 990161 | 990206 | 990250 | 990294 | 44 |
| 978 | 990339 | 990383 | 990428 | 990472 | 990516 | 990561 | 990605 | 990650 | 990694 | 990738 | 44 |
| 979 | 990783 | 990827 | 990871 | 990916 | 990960 | 991004 | 991049 | 991093 | 991137 | 991182 | 44 |
| 980 | 991226 | 991270 | 991315 | 991359 | 991403 | 991448 | 991492 | 991536 | 991580 | 991625 | 44 |
| 981 | 991669 | 991713 | 991758 | 991802 | 991846 | 991890 | 991935 | 991979 | 992023 | 992067 | 44 |
| 982 | 992111 | 992156 | 992200 | 992244 | 992288 | 992333 | 992377 | 992421 | 992465 | 992509 | 44 |
| 983 | 992554 | 992598 | 992642 | 992686 | 992730 | 992774 | 992819 | 992863 | 992907 | 992951 | 44 |
| 984 | 992995 | 993039 | 993083 | 993127 | 993172 | 993216 | 993260 | 993304 | 993348 | 993392 | 44 |
| 985 | 993436 | 993480 | 993524 | 993568 | 993613 | 993657 | 993701 | 993745 | 993789 | 993833 | 44 |
| 986 | 993877 | 993921 | 993965 | 994009 | 994053 | 994097 | 994141 | 994185 | 994229 | 994273 | 44 |
| 987 | 994317 | 994361 | 994405 | 994449 | 994493 | 994537 | 994581 | 994625 | 994669 | 994713 | 44 |
| 988 | 994757 | 994801 | 994845 | 994889 | 994933 | 994977 | 995021 | 995065 | 995108 | 995152 | 44 |
| 989 | 995196 | 995240 | 995284 | 995328 | 995372 | 995416 | 995460 | 995504 | 995547 | 995591 | 44 |
| 990 | 995635 | 995679 | 995723 | 995767 | 995811 | 995854 | 995898 | 995942 | 995986 | 996030 | 44 |
| 991 | 996074 | 996117 | 996161 | 996205 | 996249 | 996293 | 996337 | 996380 | 996424 | 996468 | 44 |
| 992 | 996512 | 996555 | 996599 | 996643 | 996687 | 996731 | 996774 | 996818 | 996862 | 996907 | 44 |
| 993 | 996949 | 996993 | 997037 | 997080 | 997124 | 997168 | 997212 | 997255 | 997299 | 997343 | 44 |
| 994 | 997386 | 997430 | 997474 | 997517 | 997561 | 997605 | 997648 | 997692 | 997736 | 997779 | 44 |
| 995 | 997823 | 997867 | 997910 | 997954 | 997998 | 998041 | 998085 | 998129 | 998172 | 998216 | 44 |
| 996 | 998259 | 998303 | 998347 | 998390 | 998434 | 998477 | 998521 | 998564 | 998608 | 998652 | 44 |
| 997 | 998695 | 998739 | 998782 | 998826 | 998869 | 998913 | 998956 | 999000 | 999043 | 999087 | 44 |
| 998 | 999131 | 999174 | 999218 | 999261 | 999305 | 999348 | 999392 | 999435 | 999479 | 999522 | 44 |
| 999 | 999565 | 999609 | 999652 | 999696 | 999739 | 999783 | 999826 | 999870 | 999913 | 999957 | 43 |
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. |

| D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43 | 4 | 9 | 13 | 17 | 21 | 26 | 30 | 34 | 39 | 45 | 4 | 9 | 13 | 18 | 22 | 27 | 31 | 36 | 40 |
| 44 | 4 | 9 | 13 | 18 | 22 | 26 | 31 | 35 | 40 | 46 | 5 | 9 | 14 | 18 | 23 | 28 | 32 | 37 | 41 |

## TABLE XXVI.

### LOG. SINES, COSINES, &c.

0h 0m — 0°

| ′ ″ | m. s. | Sine | D. | Cosec. | Tangent | D. | Cotang. | Secant | D. | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | − ∞ | | ∞ | − ∞ | | ∞ | 10·000000 | 0 | 10·000000 | 60 | 60 |
| 30 | 2 | 6·162696 | 477121 | 13·837304 | 6·162696 | 477121 | 13·837304 | 10·000000 | 0 | 10·000000 | 58 | 30 |
| 1 | 4 | 6·463726 | 221849 | 13·536274 | 6·463726 | 221849 | 13·536274 | 10·000000 | 0 | 10·000000 | 56 | 59 |
| 30 | 6 | 6·639817 | 146128 | 13·360183 | 6·639817 | 146128 | 13·360183 | 10·000000 | 0 | 10·000000 | 54 | 30 |
| 2 | 8 | 6·764756 | 109145 | 13·235244 | 6·764756 | 109145 | 13·235244 | 10·000000 | 0 | 10·000000 | 52 | 58 |
| 30 | 10 | 6·861666 | 87150 | 13·138334 | 6·861666 | 87150 | 13·138334 | 10·000000 | 0 | 10·000000 | 50 | 30 |
| 3 | 12 | 6·940847 | 72550 | 13·059153 | 6·940847 | 72551 | 13·059153 | 10·000000 | 0 | 10·000000 | 48 | 57 |
| 30 | 14 | 7·007794 | 62148 | 12·992206 | 7·007794 | 62148 | 12·992206 | 10·000000 | 0 | 10·000000 | 46 | 30 |
| 4 | 16 | 7·065786 | 54358 | 12·934214 | 7·065786 | 54357 | 12·934214 | 10·000000 | 0 | 10·000000 | 44 | 56 |
| 30 | 18 | 7·116939 | 48305 | 12·883061 | 7·116939 | 48305 | 12·883061 | 10·000000 | 0 | 10·000000 | 42 | 30 |
| 5 | 20 | 7·162696 | 43465 | 12·837304 | 7·162696 | 43466 | 12·837304 | 10·000000 | 0 | 10·000000 | 40 | 55 |
| 30 | 22 | 7·204089 | 39509 | 12·795911 | 7·204089 | 39508 | 12·795911 | 10·000001 | 0 | 10·999999 | 38 | 30 |
| 6 | 24 | 7·241877 | 36212 | 12·758123 | 7·241878 | 36213 | 12·758122 | 10·000001 | 0 | 9·999999 | 36 | 54 |
| 30 | 26 | 7·276639 | 33424 | 12·723361 | 7·276640 | 33423 | 12·723360 | 10·000001 | 0 | 9·999999 | 34 | 30 |
| 7 | 28 | 7·308824 | 31034 | 12·691176 | 7·308825 | 31035 | 12·691175 | 10·000001 | 0 | 9·999999 | 32 | 53 |
| 30 | 30 | 7·338787 | 28963 | 12·661213 | 7·338788 | 28964 | 12·661212 | 10·000001 | 0 | 9·999999 | 30 | 30 |
| 8 | 32 | 7·366816 | 27153 | 12·633184 | 7·366817 | 27152 | 12·633183 | 10·000001 | 0 | 9·999999 | 28 | 52 |
| 30 | 34 | 7·393145 | 25554 | 12·606855 | 7·393146 | 25554 | 12·606854 | 10·000001 | 0 | 9·999999 | 26 | 30 |
| 9 | 36 | 7·417968 | 24133 | 12·582032 | 7·417970 | 24134 | 12·582030 | 10·000001 | 0 | 9·999999 | 24 | 51 |
| 30 | 38 | 7·441449 | 22863 | 12·558551 | 7·441451 | 22863 | 12·558549 | 10·000002 | 0 | 9·999998 | 22 | 30 |
| 10 | 40 | 7·463726 | 21719 | 12·536274 | 7·463727 | 21719 | 12·536273 | 10·000002 | 0 | 9·999998 | 20 | 50 |
| 30 | 42 | 7·484915 | 20685 | 12·515085 | 7·484917 | 20685 | 12·515083 | 10·000002 | 0 | 9·999998 | 18 | 30 |
| 11 | 44 | 7·505118 | 19744 | 12·494882 | 7·505120 | 19744 | 12·494880 | 10·000002 | 0 | 9·999998 | 16 | 49 |
| 30 | 46 | 7·524423 | 18885 | 12·475577 | 7·524426 | 18886 | 12·475574 | 10·000002 | 0 | 9·999998 | 14 | 30 |
| 12 | 48 | 7·542906 | 18098 | 12·457094 | 7·542909 | 18098 | 12·457091 | 10·000003 | 0 | 9·999997 | 12 | 48 |
| 30 | 50 | 7·560635 | 17374 | 12·439365 | 7·560638 | 17374 | 12·439362 | 10·000003 | 0 | 9·999997 | 10 | 30 |
| 13 | 52 | 7·577668 | 16706 | 12·422332 | 7·577672 | 16706 | 12·422328 | 10·000003 | 0 | 9·999997 | 8 | 47 |
| 30 | 54 | 7·594059 | 16087 | 12·405941 | 7·594062 | 16087 | 12·405938 | 10·000003 | 0 | 9·999997 | 6 | 30 |
| 14 | 56 | 7·609853 | 15512 | 12·390147 | 7·609857 | 15512 | 12·390143 | 10·000004 | 0 | 9·999996 | 4 | 46 |
| 30 | 58 | 7·625093 | 14977 | 12·374907 | 7·625097 | 14978 | 12·374903 | 10·000004 | 0 | 9·999996 | 2 | 30 |
| 15 | 1 | 7·639816 | 14478 | 12·360184 | 7·639820 | 14478 | 12·360180 | 10·000004 | 0 | 9·999996 | 59 | 45 |
| 30 | 2 | 7·654056 | 14010 | 12·345944 | 7·654061 | 14011 | 12·345939 | 10·000004 | 0 | 9·999996 | 58 | 30 |
| 16 | 4 | 7·667845 | 13573 | 12·332155 | 7·667849 | 13573 | 12·332151 | 10·000005 | 0 | 9·999995 | 56 | 44 |
| 30 | 6 | 7·681208 | 13161 | 12·318792 | 7·681213 | 13161 | 12·318787 | 10·000005 | 0 | 9·999995 | 54 | 30 |
| 17 | 8 | 7·694173 | 12774 | 12·305827 | 7·694179 | 12775 | 12·305821 | 10·000005 | 0 | 9·999995 | 52 | 43 |
| 30 | 10 | 7·706762 | 12410 | 12·293238 | 7·706768 | 12409 | 12·293232 | 10·000006 | 0 | 9·999994 | 50 | 30 |
| 18 | 12 | 7·718997 | 12064 | 12·281003 | 7·719003 | 12065 | 12·280997 | 10·000006 | 0 | 9·999994 | 48 | 42 |
| 30 | 14 | 7·730896 | 11738 | 12·269104 | 7·730902 | 11739 | 12·269098 | 10·000006 | 0 | 9·999994 | 46 | 30 |
| 19 | 16 | 7·742478 | 11430 | 12·257522 | 7·742484 | 11429 | 12·257516 | 10·000007 | 0 | 9·999993 | 44 | 41 |
| 30 | 18 | 7·753758 | 11136 | 12·246242 | 7·753765 | 11137 | 12·246235 | 10·000007 | 0 | 9·999993 | 42 | 30 |
| 20 | 20 | 7·764754 | 10858 | 12·235246 | 7·764761 | 10858 | 12·235239 | 10·000007 | 0 | 9·999993 | 40 | 40 |
| 30 | 22 | 7·775477 | 10593 | 12·224523 | 7·775485 | 10593 | 12·224515 | 10·000008 | 0 | 9·999992 | 38 | 30 |
| 21 | 24 | 7·785943 | 10340 | 12·214057 | 7·785951 | 10342 | 12·214049 | 10·000008 | 0 | 9·999992 | 36 | 39 |
| 30 | 26 | 7·796162 | 10100 | 12·203838 | 7·796170 | 10100 | 12·203830 | 10·000009 | 0 | 9·999991 | 34 | 30 |
| 22 | 28 | 7·806146 | 9871 | 12·193854 | 7·806155 | 9871 | 12·193845 | 10·000009 | 0 | 9·999991 | 32 | 38 |
| 30 | 30 | 7·815906 | 9651 | 12·184094 | 7·815915 | 9652 | 12·184085 | 10·000009 | 0 | 9·999991 | 30 | 30 |
| 23 | 32 | 7·825451 | 9442 | 12·174549 | 7·825460 | 9442 | 12·174540 | 10·000010 | 0 | 9·999990 | 28 | 37 |
| 30 | 34 | 7·834791 | 9240 | 12·165209 | 7·834801 | 9241 | 12·165199 | 10·000010 | 0 | 9·999990 | 26 | 30 |
| 24 | 36 | 7·843934 | 9048 | 12·156066 | 7·843944 | 9048 | 12·156056 | 10·000011 | 0 | 9·999989 | 24 | 36 |
| 30 | 38 | 7·852889 | 8864 | 12·147111 | 7·852900 | 8864 | 12·147100 | 10·000011 | 0 | 9·999989 | 22 | 30 |
| 25 | 40 | 7·861662 | 8686 | 12·138338 | 7·861674 | 8686 | 12·138326 | 10·000011 | 0 | 9·999989 | 20 | 35 |
| 30 | 42 | 7·870262 | 8515 | 12·129738 | 7·870274 | 8516 | 12·129726 | 10·000012 | 0 | 9·999988 | 18 | 30 |
| 26 | 44 | 7·878695 | 8352 | 12·121305 | 7·878708 | 8353 | 12·121292 | 10·000012 | 0 | 9·999988 | 16 | 34 |
| 30 | 46 | 7·886963 | 8195 | 12·113032 | 7·886981 | 8195 | 12·113019 | 10·000013 | 0 | 9·999987 | 14 | 30 |
| 27 | 48 | 7·895085 | 8042 | 12·104915 | 7·895099 | 8043 | 12·104901 | 10·000013 | 0 | 9·999987 | 12 | 33 |
| 30 | 50 | 7·903054 | 7896 | 12·096946 | 7·903068 | 7897 | 12·096932 | 10·000014 | 0 | 9·999986 | 10 | 30 |
| 28 | 52 | 7·910879 | 7756 | 12·089121 | 7·910894 | 7755 | 12·089106 | 10·000014 | 1 | 9·999986 | 8 | 32 |
| 30 | 54 | 7·918566 | 7619 | 12·081434 | 7·918581 | 7620 | 12·081419 | 10·000015 | 1 | 9·999985 | 6 | 30 |
| 29 | 56 | 7·926119 | 7488 | 12·073881 | 7·926134 | 7488 | 12·073866 | 10·000015 | 1 | 9·999985 | 4 | 31 |
| 30 | 58 | 7·933543 | 7361 | 12·066457 | 7·933559 | 7362 | 12·066441 | 10·000016 | 1 | 9·999984 | 2 | 30 |
| 30 | 2 | 7·940842 | 7238 | 12·059158 | 7·940858 | 7239 | 12·059142 | 10·000017 | 1 | 9·999983 | 58 | 30 |
| ′ ″ | m. s. | Cosine | D. | Secant | Cotang. | D. | Tangent | Cosec. | D. | Sine | m. s. | ′ ″ |

89° — 5h 58m

## TABLE XXVI.—(*continued*).

### LOG. SINES. COSINES. &c.

$0^h\ 2^m$ — 0°

| ′ ″ | m. s. | Sine | D. | Cosec. | Tangent | D. | Cotang. | Secant | D. | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 7·940842 | 7238 | 12·059158 | 7·940858 | 7239 | 12·059142 | 10·000017 | | 9·999983 | 58 | 30 |
| 30 | 2 | 7·948020 | 7119 | 12·051980 | 7·948037 | 7120 | 12·051963 | 10·000017 | 1 | 9·999983 | 58 | 30 |
| 31 | 4 | 7·955082 | 7005 | 12·044918 | 7·955100 | 7005 | 12·044900 | 10·000018 | 1 | 9·999982 | 56 | 29 |
| 30 | 6 | 7·962031 | 6894 | 12·037969 | 7·962049 | 6894 | 12·037951 | 10·000018 | 1 | 9·999982 | 54 | 30 |
| 32 | 8 | 7·968870 | 6785 | 12·031130 | 7·968889 | 6787 | 12·031111 | 10·000019 | 1 | 9·999981 | 52 | 28 |
| 30 | 10 | 7·975603 | 6682 | 12·024397 | 7·975622 | 6682 | 12·024378 | 10·000019 | 1 | 9·999981 | 50 | 30 |
| 33 | 12 | 7·982233 | 6580 | 12·017767 | 7·982253 | 6580 | 12·017747 | 10·000020 | 1 | 9·999980 | 48 | 27 |
| 30 | 14 | 7·988764 | 6482 | 12·011236 | 7·988785 | 6483 | 12·011215 | 10·000021 | 1 | 9·999979 | 46 | 30 |
| 34 | 16 | 7·995198 | 6387 | 12·004802 | 7·995219 | 6387 | 12·004781 | 10·000021 | 1 | 9·999979 | 44 | 26 |
| 30 | 18 | 8·001538 | 6294 | 11·998462 | 8·001560 | 6295 | 11·998440 | 10·000022 | 1 | 9·999978 | 42 | 30 |
| 35 | 20 | 8·007787 | 6204 | 11·992213 | 8·007809 | 6204 | 11·992191 | 10·000023 | 1 | 9·999977 | 40 | 25 |
| 30 | 22 | 8·013947 | 6116 | 11·986053 | 8·013970 | 6118 | 11·986030 | 10·000023 | 1 | 9·999977 | 38 | 30 |
| 36 | 24 | 8·020021 | 6032 | 11·979979 | 8·020045 | 6032 | 11·979956 | 10·000024 | 1 | 9·999976 | 36 | 24 |
| 30 | 26 | 8·026011 | 5949 | 11·973989 | 8·026035 | 5950 | 11·973965 | 10·000024 | 1 | 9·999976 | 34 | 30 |
| 37 | 28 | 8·031919 | 5869 | 11·968081 | 8·031945 | 5869 | 11·968055 | 10·000025 | 1 | 9·999975 | 32 | 23 |
| 30 | 30 | 8·037749 | 5790 | 11·962251 | 8·037775 | 5792 | 11·962225 | 10·000026 | 1 | 9·999974 | 30 | 30 |
| 38 | 32 | 8·043501 | 5715 | 11·956499 | 8·043527 | 5714 | 11·956473 | 10·000027 | 1 | 9·999973 | 28 | 22 |
| 30 | 34 | 8·049178 | 5640 | 11·950822 | 8·049205 | 5641 | 11·950795 | 10·000027 | 1 | 9·999973 | 26 | 30 |
| 39 | 36 | 8·054781 | 5567 | 11·945219 | 8·054809 | 5569 | 11·945191 | 10·000028 | 1 | 9·999972 | 24 | 21 |
| 30 | 38 | 8·060314 | 5498 | 11·939686 | 8·060342 | 5498 | 11·939658 | 10·000029 | 1 | 9·999971 | 22 | 30 |
| 40 | 40 | 8·065776 | 5428 | 11·934224 | 8·065806 | 5429 | 11·934194 | 10·000029 | 1 | 9·999971 | 20 | 20 |
| 30 | 42 | 8·071171 | 5362 | 11·928829 | 8·071201 | 5362 | 11·928[illegible]99 | 10·000030 | 1 | 9·999970 | 18 | 30 |
| 41 | 44 | 8·076500 | 5296 | 11·923500 | 8·076531 | 5297 | 11·923469 | 10·000031 | 1 | 9·999969 | 16 | 19 |
| 30 | 46 | 8·081764 | 5232 | 11·918236 | 8·081795 | 5233 | 11·918205 | 10·000032 | 1 | 9·999968 | 14 | 30 |
| 42 | 48 | 8·086965 | 5170 | 11·913035 | 8·086997 | 5171 | 11·913003 | 10·000032 | 1 | 9·999968 | 12 | 18 |
| 30 | 50 | 8·092104 | 5109 | 11·907896 | 8·092137 | 5110 | 11·907863 | 10·000033 | 1 | 9·999967 | 10 | 30 |
| 43 | 52 | 8·097183 | 5050 | 11·902817 | 8·097217 | 5050 | 11·902783 | 10·000034 | 1 | 9·999966 | 8 | 17 |
| 30 | 54 | 8·102204 | 4991 | 11·897796 | 8·102239 | 4993 | 11·897761 | 10·000035 | 1 | 9·999965 | 6 | 30 |
| 44 | 56 | 8·107167 | 4935 | 11·892833 | 8·107203 | 4935 | 11·892797 | 10·000036 | 1 | 9·999964 | 4 | 16 |
| 30 | 58 | 8·112074 | 4880 | 11·887926 | 8·112110 | 4881 | 11·887890 | 10·000036 | 1 | 9·999964 | 2 | 30 |
| 45 | **3** | 8·116926 | 4825 | 11·883074 | 8·116963 | 4826 | 11·883037 | 10·000037 | 1 | 9·999963 | **57** | 15 |
| 30 | 2 | 8·121725 | 4772 | 11·878275 | 8·121763 | 4773 | 11·878237 | 10·000038 | 1 | 9·999962 | 58 | 30 |
| 46 | 4 | 8·126471 | 4721 | 11·873529 | 8·126510 | 4721 | 11·873490 | 10·000039 | 1 | 9·999961 | 56 | 14 |
| 30 | 6 | 8·131166 | 4669 | 11·868834 | 8·131206 | 4671 | 11·868794 | 10·000040 | 1 | 9·999960 | 54 | 30 |
| 47 | 8 | 8·135810 | 4620 | 11·864190 | 8·135851 | 4620 | 11·864149 | 10·000041 | 1 | 9·999959 | 52 | 13 |
| 30 | 10 | 8·140406 | 4572 | 11·859594 | 8·140447 | 4572 | 11·859553 | 10·000041 | 1 | 9·999959 | 50 | 30 |
| 48 | 12 | 8·144953 | 4523 | 11·855047 | 8·144996 | 4525 | 11·855004 | 10·000042 | 1 | 9·999958 | 48 | 12 |
| 30 | 14 | 8·149453 | 4477 | 11·850547 | 8·149497 | 4478 | 11·850503 | 10·000043 | 1 | 9·999957 | 46 | 30 |
| 49 | 16 | 8·153907 | 4431 | 11·846093 | 8·153952 | 4432 | 11·846048 | 10·000044 | 1 | 9·999956 | 44 | 11 |
| 30 | 18 | 8·158316 | 4387 | 11·841684 | 8·158361 | 4388 | 11·841639 | 10·000045 | 1 | 9·999955 | 42 | 30 |
| 50 | 20 | 8·162681 | 4343 | 11·837319 | 8·162727 | 4343 | 11·837273 | 10·000046 | 1 | 9·999954 | 40 | 10 |
| 30 | 22 | 8·167002 | 4299 | 11·832998 | 8·167049 | 4301 | 11·832951 | 10·000047 | 1 | 9·999953 | 38 | 30 |
| 51 | 24 | 8·171280 | 4258 | 11·828720 | 8·171328 | 4258 | 11·828672 | 10·000048 | 1 | 9·999952 | 36 | 9 |
| 30 | 26 | 8·175517 | 4216 | 11·824483 | 8·175566 | 4217 | 11·824434 | 10·000049 | 1 | 9·999951 | 34 | 30 |
| 52 | 28 | 8·179713 | 4176 | 11·820287 | 8·179763 | 4177 | 11·820237 | 10·000050 | 1 | 9·999950 | 32 | 8 |
| 30 | 30 | 8·183869 | 4136 | 11·816131 | 8·183919 | 4137 | 11·816081 | 10·000051 | 1 | 9·999949 | 30 | 30 |
| 53 | 32 | 8·187985 | 4096 | 11·812015 | 8·188036 | 4097 | 11·811964 | 10·000052 | 1 | 9·999948 | 28 | 7 |
| 30 | 34 | 8·192062 | 4059 | 11·807938 | 8·192115 | 4060 | 11·807885 | 10·000053 | 1 | 9·999947 | 26 | 30 |
| 54 | 36 | 8·196102 | 4021 | 11·803898 | 8·196156 | 4022 | 11·803844 | 10·000054 | 1 | 9·999946 | 24 | 6 |
| 30 | 38 | 8·200104 | 3984 | 11·799896 | 8·200159 | 3985 | 11·799841 | 10·000055 | 1 | 9·999945 | 22 | 30 |
| 55 | 40 | 8·204070 | 3948 | 11·795930 | 8·204126 | 3949 | 11·795874 | 10·000056 | 1 | 9·999944 | 20 | 5 |
| 30 | 42 | 8·208000 | 3912 | 11·792000 | 8·208057 | 3913 | 11·791943 | 10·000057 | 1 | 9·999943 | 18 | 30 |
| 56 | 44 | 8·211895 | 3877 | 11·788105 | 8·211953 | 3878 | 11·788047 | 10·000058 | 1 | 9·999942 | 16 | 4 |
| 30 | 46 | 8·215755 | 3843 | 11·784245 | 8·215814 | 3844 | 11·784186 | 10·000059 | 1 | 9·999941 | 14 | 30 |
| 57 | 48 | 8·219581 | 3810 | 11·780419 | 8·219641 | 3811 | 11·780359 | 10·000060 | 1 | 9·999940 | 12 | 3 |
| 30 | 50 | 8·223374 | 3776 | 11·776626 | 8·223434 | 3777 | 11·776566 | 10·000061 | 1 | 9·999939 | 10 | 30 |
| 58 | 52 | 8·227134 | 3743 | 11·772866 | 8·227195 | 3745 | 11·772805 | 10·000062 | 1 | 9·999938 | 8 | 2 |
| 30 | 54 | 8·230861 | 3712 | 11·769139 | 8·230924 | 3712 | 11·769076 | 10·000063 | 1 | 9·999937 | 6 | 30 |
| 59 | 56 | 8·234557 | 3680 | 11·765443 | 8·234621 | 3681 | 11·765379 | 10·000064 | 1 | 9·999936 | 4 | 1 |
| 30 | 58 | 8·238221 | 3649 | 11·761779 | 8·238286 | 3651 | 11·761714 | 10·000065 | 1 | 9·999935 | 2 | 30 |
| 60 | **4** | 8·241855 | 3619 | 11·758145 | 8·241921 | 3620 | 11·758079 | 10·000066 | 1 | 9·999934 | 0 | 0 |
| ′ ″ | m. s. | Cosine | D. | Secant | Cotang. | D. | Tangent | Cosec. | D. | Sine | m. s. | ′ ″ |

89° — $5^h\ 56^m$

TABLE XXVI.—*(continued)*.

LOG. SINES, COSINES, &c.

0h 4m — 1°

| ′ ″ | m. s. | Sine. | D. | Cosec. | Tangent | D. | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 8·241855 | 3619 | 11·758145 | 8·241921 | 3620 | 11·758079 | 10·000066 | | 9·999934 | 56 | 60 |
| 30 | 2 | 8·245459 | 3589 | 11·754541 | 8·245526 | 3590 | 11·754474 | 10·000067 | 1″ 0 | 9·999933 | 58 | 30 |
| 1 | 4 | 8·249033 | 3559 | 11·750967 | 8·249102 | 3560 | 11·750898 | 10·000068 | 2 0 | 9·999932 | 56 | 59 |
| 30 | 6 | 8·252578 | 3531 | 11·747422 | 8·252648 | 3532 | 11·747352 | 10·000069 | 3 0 | 9·999931 | 54 | 30 |
| 2 | 8 | 8·256094 | 3502 | 11·743906 | 8·256165 | 3503 | 11·743835 | 10·000071 | 4 0 | 9·999929 | 52 | 58 |
| 30 | 10 | 8·259582 | 3474 | 11·740418 | 8·259654 | 3475 | 11·740346 | 10·000072 | 5 0 | 9·999928 | 50 | 30 |
| 3 | 12 | 8·263042 | 3446 | 11·736958 | 8·263115 | 3448 | 11·736885 | 10·000073 | 6 0 | 9·999927 | 48 | 57 |
| 30 | 14 | 8·266475 | 3419 | 11·733525 | 8·266549 | 3420 | 11·733451 | 10·000074 | 7 0 | 9·999926 | 46 | 30 |
| 4 | 16 | 8·269881 | 3393 | 11·730119 | 8·269956 | 3394 | 11·730044 | 10·000075 | 8 0 | 9·999925 | 44 | 56 |
| 30 | 18 | 8·273260 | 3366 | 11·726740 | 8·273337 | 3367 | 11·726663 | 10·000076 | 9 0 | 9·999924 | 42 | 30 |
| 5 | 20 | 8·276614 | 3341 | 11·723386 | 8·276691 | 3342 | 11·723309 | 10·000078 | 10 0 | 9·999922 | 40 | 55 |
| 30 | 22 | 8·279941 | 3314 | 11·720059 | 8·280020 | 3316 | 11·719980 | 10·000079 | 11 0 | 9·999921 | 38 | 30 |
| 6 | 24 | 8·283243 | 3290 | 11·716757 | 8·283323 | 3291 | 11·716677 | 10·000080 | 12 0 | 9·999920 | 36 | 54 |
| 30 | 26 | 8·286521 | 3265 | 11·713479 | 8·286602 | 3266 | 11·713398 | 10·000081 | 13 1 | 9·999919 | 34 | 30 |
| 7 | 28 | 8·289773 | 3241 | 11·710227 | 8·289856 | 3242 | 11·710144 | 10·000082 | 14 1 | 9·999918 | 32 | 53 |
| 30 | 30 | 8·293002 | 3216 | 11·706998 | 8·293086 | 3218 | 11·706914 | 10·000084 | 15 1 | 9·999916 | 30 | 30 |
| 8 | 32 | 8·296207 | 3193 | 11·703793 | 8·296292 | 3194 | 11·703708 | 10·000085 | 16 1 | 9·999915 | 28 | 52 |
| 30 | 34 | 8·299388 | 3170 | 11·700612 | 8·299474 | 3171 | 11·700526 | 10·000086 | 17 1 | 9·999914 | 26 | 30 |
| 9 | 36 | 8·302546 | 3147 | 11·697454 | 8·302634 | 3148 | 11·697366 | 10·000087 | 18 1 | 9·999913 | 21 | 51 |
| 30 | 38 | 8·305681 | 3124 | 11·694319 | 8·305770 | 3125 | 11·694230 | 10·000089 | 19 1 | 9·999911 | 22 | 30 |
| 10 | 40 | 8·308794 | 3102 | 11·691206 | 8·308884 | 3103 | 11·691116 | 10·000090 | 20 1 | 9·999910 | 20 | 50 |
| 30 | 42 | 8·311885 | 3080 | 11·688115 | 8·311976 | 3081 | 11·688024 | 10·000091 | 21 1 | 9·999909 | 18 | 30 |
| 11 | 44 | 8·314954 | 3058 | 11·685046 | 8·315046 | 3059 | 11·684954 | 10·000093 | 22 1 | 9·999907 | 16 | 49 |
| 30 | 46 | 8·318001 | 3036 | 11·681999 | 8·318095 | 3038 | 11·681905 | 10·000094 | 23 1 | 9·999906 | 14 | 30 |
| 12 | 48 | 8·321027 | 3016 | 11·678973 | 8·321122 | 3017 | 11·678878 | 10·000095 | 24 1 | 9·999905 | 12 | 48 |
| 30 | 50 | 8·324032 | 2995 | 11·675968 | 8·324129 | 2996 | 11·675871 | 10·000097 | 25 1 | 9·999903 | 10 | 30 |
| 13 | 52 | 8·327016 | 2974 | 11·672984 | 8·327114 | 2975 | 11·672886 | 10·000098 | 26 1 | 9·999902 | 8 | 47 |
| 30 | 54 | 8·329980 | 2954 | 11·670020 | 8·330080 | 2956 | 11·669920 | 10·000099 | 27 1 | 9·999901 | 6 | 30 |
| 14 | 56 | 8·332924 | 2934 | 11·667076 | 8·333025 | 2935 | 11·666975 | 10·000101 | 28 1 | 9·999899 | 4 | 46 |
| 30 | 58 | 8·335848 | 2914 | 11·664152 | 8·335950 | 2916 | 11·664050 | 10·000102 | 29 1 | 9·999898 | 2 | 30 |
| 15 | 5 | 8·338753 | 2895 | 11·661247 | 8·338856 | 2806 | 11·661144 | 10·000103 | 30 1 | 9·999897 | 55 | 45 |
| 30 | 2 | 8·341638 | 2876 | 11·658362 | 8·341743 | 2877 | 11·658257 | 10·000105 | 1 0 | 9·999895 | 58 | 30 |
| 16 | 4 | 8·344504 | 2856 | 11·655496 | 8·344610 | 2858 | 11·655390 | 10·000106 | 2 0 | 9·999894 | 56 | 44 |
| 30 | 6 | 8·347352 | 2838 | 11·652648 | 8·347459 | 2840 | 11·652541 | 10·000108 | 3 0 | 9·999892 | 54 | 30 |
| 17 | 8 | 8·350181 | 2820 | 11·649819 | 8·350289 | 2821 | 11·649711 | 10·000109 | 4 0 | 9·999891 | 52 | 43 |
| 30 | 10 | 8·352991 | 2801 | 11·647009 | 8·353101 | 2803 | 11·646899 | 10·000110 | 5 0 | 9·999890 | 50 | 30 |
| 18 | 12 | 8·355783 | 2784 | 11·644217 | 8·355895 | 2784 | 11·644105 | 10·000112 | 6 0 | 9·999888 | 48 | 42 |
| 30 | 14 | 8·358558 | 2766 | 11·641442 | 8·358671 | 2768 | 11·641329 | 10·000[illegible]3 | 7 0 | 9·999887 | 46 | 30 |
| 19 | 16 | 8·361315 | 2748 | 11·638685 | 8·361430 | 2749 | 11·638570 | 10·000115 | 8 0 | 9·999885 | 41 | 41 |
| 30 | 18 | 8·364055 | 2731 | 11·635945 | 8·364171 | 2733 | 11·635829 | 10·000116 | 9 0 | 9·999884 | 42 | 30 |
| 20 | 20 | 8·366777 | 2714 | 11·633223 | 8·366895 | 2715 | 11·633105 | 10·000118 | 10 1 | 9·999882 | 40 | 40 |
| 30 | 22 | 8·369482 | 2697 | 11·630518 | 8·369601 | 2699 | 11·630399 | 10·000119 | 11 1 | 9·999881 | 38 | 30 |
| 21 | 24 | 8·372171 | 2680 | 11·627829 | 8·372292 | 2681 | 11·627708 | 10·000121 | 12 1 | 9·999879 | 36 | 39 |
| 30 | 26 | 8·374843 | 2664 | 11·625157 | 8·374965 | 2666 | 11·625035 | 10·000122 | 13 1 | 9·999878 | 34 | 30 |
| 22 | 28 | 8·377499 | 2648 | 11·622501 | 8·377622 | 2649 | 11·622378 | 10·000124 | 14 1 | 9·999876 | 32 | 38 |
| 30 | 30 | 8·380138 | 2631 | 11·619862 | 8·380263 | 2633 | 11·619737 | 10·000125 | 15 1 | 9·999875 | 30 | 30 |
| 23 | 32 | 8·382762 | 2616 | 11·617238 | 8·382889 | 2617 | 11·617111 | 10·000127 | 16 1 | 9·999873 | 28 | 37 |
| 30 | 34 | 8·385370 | 2600 | 11·614630 | 8·385498 | 2602 | 11·614502 | 10·000128 | 17 1 | 9·999872 | 26 | 30 |
| 24 | 36 | 8·387962 | 2585 | 11·612038 | 8·388092 | 2586 | 11·611908 | 10·000130 | 18 1 | 9·999870 | 24 | 36 |
| 30 | 38 | 8·390539 | 2569 | 11·609461 | 8·390670 | 2571 | 11·609330 | 10·000131 | 19 1 | 9·999869 | 22 | 30 |
| 25 | 40 | 8·393101 | 2554 | 11·606899 | 8·393234 | 2556 | 11·606766 | 10·000133 | 20 1 | 9·999867 | 20 | 35 |
| 30 | 42 | 8·395647 | 2539 | 11·604352 | 8·395782 | 2540 | 11·604218 | 10·000134 | 21 1 | 9·999866 | 18 | 30 |
| 26 | 44 | 8·398179 | 2525 | 11·601821 | 8·398315 | 2526 | 11·601685 | 10·000136 | 22 1 | 9·999864 | 16 | 34 |
| 30 | 46 | 8·400696 | 2510 | 11·599304 | 8·400834 | 2512 | 11·599166 | 10·000137 | 23 1 | 9·999863 | 14 | 30 |
| 27 | 48 | 8·403199 | 2495 | 11·596801 | 8·403338 | 2497 | 11·596662 | 10·000139 | 24 1 | 9·999861 | 12 | 33 |
| 30 | 50 | 8·405687 | 2481 | 11·594313 | 8·405828 | 2483 | 11·594172 | 10·000141 | 25 1 | 9·999859 | 10 | 30 |
| 28 | 52 | 8·408161 | 2467 | 11·591839 | 8·408304 | 2468 | 11·591696 | 10·000142 | 26 1 | 9·999858 | 8 | 32 |
| 30 | 54 | 8·410621 | 2453 | 11·589379 | 8·410765 | 2455 | 11·58923[illegible] | 10·000144 | 27 1 | 9·999856 | 6 | 30 |
| 29 | 56 | 8·413068 | 2440 | 11·586932 | 8·413213 | 2441 | 11·586787 | 10·000146 | 28 1 | 9·999854 | 4 | 31 |
| 30 | 58 | 8·415500 | 2425 | 11·584500 | 8·415647 | 2427 | 11·584353 | 10·000147 | 29 1 | 9·999853 | 2 | 30 |
| 30 | 6 | 8·417919 | 2412 | 11·582081 | 8·418068 | 2414 | 11·581932 | 10·000149 | 30 2 | 9·999851 | 0 | 30 |
| ′ ″ | m. s. | Cosine | D. | Secant | Cotang. | D. | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

88° — 5h 54m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$0^h\ 6^m$ — 1°

| ′ ″ | m. s. | Sine | D. | Cosec. | Tangent | D. | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 8·417919 | 2412 | 11·582081 | 8·418068 | 2414 | 11·581932 | 10·000149 | | 9·999851 | 54 | 30 |
| 30 | 2 | 8·420325 | 2399 | 11·579675 | 8·420475 | 2401 | 11·579525 | 10·000151 | 1″ 0 | 9·999849 | 58 | 30 |
| 31 | 4 | 8·422717 | 2386 | 11·577283 | 8·422869 | 2387 | 11·577131 | 10·000152 | 2 0 | 9·999848 | 56 | 29 |
| 30 | 6 | 8·425096 | 2373 | 11·574904 | 8·425250 | 2374 | 11·574750 | 10·000154 | 3 0 | 9·999846 | 54 | 30 |
| 32 | 8 | 8·427462 | 2359 | 11·572538 | 8·427618 | 2362 | 11·572382 | 10·000156 | 4 0 | 9·999844 | 52 | 28 |
| 30 | 10 | 8·429815 | 2347 | 11·570185 | 8·429973 | 2348 | 11·570027 | 10·000157 | 5 0 | 9·999843 | 50 | 30 |
| 33 | 12 | 8·432156 | 2335 | 11·567844 | 8·432315 | 2336 | 11·567685 | 10·000159 | 6 0 | 9·999841 | 48 | 27 |
| 30 | 14 | 8·434484 | 2322 | 11·565516 | 8·434645 | 2324 | 11·565355 | 10·000161 | 7 0 | 9·999839 | 46 | 30 |
| 34 | 16 | 8·436800 | 2309 | 11·563200 | 8·436962 | 2311 | 11·563038 | 10·000162 | 8 0 | 9·999838 | | 26 |
| 30 | 18 | 8·439103 | 2297 | 11·560897 | 8·439267 | 2299 | 11·560733 | 10·000164 | 9 0 | 9·999836 | 42 | 30 |
| 35 | 20 | 8·441394 | 2286 | 11·558606 | 8·441560 | 2287 | 11·558440 | 10·000166 | 10 1 | 9·999834 | 40 | 25 |
| 30 | 22 | 8·443674 | 2273 | 11·556326 | 8·443841 | 2275 | 11·556159 | 10·000168 | 11 1 | 9·999832 | 38 | 30 |
| 36 | 24 | 8·445941 | 2261 | 11·554059 | 8·446110 | 2263 | 11·553890 | 10·000169 | 12 1 | 9·999831 | 36 | 24 |
| 30 | 26 | 8·448196 | 2250 | 11·551804 | 8·448368 | 2252 | 11·551632 | 10·000171 | 13 1 | 9·999829 | 34 | 30 |
| 37 | 28 | 8·450440 | 2238 | 11·549560 | 8·450613 | 2240 | 11·549387 | 10·000173 | 14 1 | 9·999827 | 32 | 23 |
| 30 | 30 | 8·452673 | 2226 | 11·547327 | 8·452847 | 2228 | 11·547153 | 10·000175 | 15 1 | 9·999825 | 30 | 30 |
| 38 | 32 | 8·454893 | 2216 | 11·545107 | 8·455070 | 2217 | 11·544930 | 10·000176 | 16 1 | 9·999824 | 28 | 22 |
| 30 | 34 | 8·457103 | 2203 | 11·542897 | 8·457281 | 2206 | 11·542719 | 10·000178 | 17 1 | 9·999822 | 26 | 30 |
| 39 | 36 | 8·459301 | 2193 | 11·540699 | 8·459481 | 2194 | 11·540519 | 10·000180 | 18 1 | 9·999820 | 24 | 21 |
| 30 | 38 | 8·461489 | 2182 | 11·538511 | 8·461670 | 2184 | 11·538330 | 10·000182 | 19 1 | 9·999818 | 22 | 30 |
| 40 | 40 | 8·463665 | 2171 | 11·536335 | 8·463849 | 2173 | 11·536151 | 10·000184 | 20 1 | 9·999816 | 20 | 20 |
| 30 | 42 | 8·465830 | 2160 | 11·534170 | 8·466016 | 2162 | 11·533984 | 10·000186 | 21 1 | 9·999814 | 18 | 30 |
| 41 | 44 | 8·467985 | 2149 | 11·532015 | 8·468172 | 2151 | 11·531828 | 10·000187 | 22 1 | 9·999813 | 16 | 19 |
| 30 | 46 | 8·470129 | 2139 | 11·529871 | 8·470318 | 2140 | 11·529682 | 10·000189 | 23 1 | 9·999811 | 14 | 30 |
| 42 | 48 | 8·472263 | 2128 | 11·527737 | 8·472454 | 2131 | 11·527546 | 10·000191 | 24 1 | 9·999809 | 12 | 18 |
| 30 | 50 | 8·474386 | 2118 | 11·525614 | 8·474579 | 2119 | 11·525421 | 10·000193 | 25 2 | 9·999807 | 10 | 30 |
| 43 | 52 | 8·476498 | 2108 | 11·523502 | 8·476693 | 2110 | 11·523307 | 10·000195 | 26 2 | 9·999805 | 8 | 17 |
| 30 | 54 | 8·478601 | 2097 | 11·521399 | 8·478798 | 2099 | 11·521202 | 10·000197 | 27 2 | 9·999803 | 6 | 30 |
| 44 | 56 | 8·480693 | 2088 | 11·519307 | 8·480892 | 2089 | 11·519108 | 10·000199 | 28 2 | 9·999801 | 4 | 16 |
| 30 | 58 | 8·482776 | 2077 | 11·517224 | 8·482976 | 2080 | 11·517024 | 10·000201 | 29 2 | 9·999799 | 2 | 30 |
| 45 | **7** | 8·484848 | 2067 | 11·515152 | 8·485050 | 2069 | 11·514950 | 10·000203 | 30 2 | 9·999797 | **53** | 15 |
| 30 | 2 | 8·486910 | 2058 | 11·513090 | 8·487115 | 2060 | 11·512885 | 10·000205 | 1 0 | 9·999795 | 58 | 30 |
| 46 | 4 | 8·488963 | 2048 | 11·511037 | 8·489170 | 2049 | 11·510830 | 10·000206 | 2 0 | 9·999794 | 56 | 14 |
| 30 | 6 | 8·491006 | 2038 | 11·508994 | 8·491215 | 2041 | 11·508785 | 10·000208 | 3 0 | 9·999792 | 54 | 30 |
| 47 | 8 | 8·493040 | 2029 | 11·506960 | 8·493250 | 2030 | 11·506750 | 10·000210 | 4 0 | 9·999790 | 52 | 13 |
| 30 | 10 | 8·495064 | 2019 | 11·504936 | 8·495276 | 2022 | 11·504724 | 10·000212 | 5 0 | 9·999788 | 50 | 30 |
| 48 | 12 | 8·497078 | 2010 | 11·502922 | 8·497293 | 2012 | 11·502707 | 10·000214 | 6 0 | 9·999786 | 48 | 12 |
| 30 | 14 | 8·499084 | 2001 | 11·500916 | 8·499300 | 2002 | 11·500700 | 10·000216 | 7 0 | 9·999784 | 46 | 30 |
| 49 | 16 | 8·501080 | 1991 | 11·498920 | 8·501298 | 1994 | 11·498702 | 10·000218 | 8 1 | 9·999782 | 44 | 11 |
| 30 | 18 | 8·503067 | 1983 | 11·496933 | 8·503287 | 1984 | 11·496713 | 10·000220 | 9 1 | 9·999780 | 42 | 30 |
| 50 | 20 | 8·505045 | 1973 | 11·494955 | 8·505267 | 1976 | 11·494733 | 10·000222 | 10 1 | 9·999778 | 40 | 10 |
| 30 | 22 | 8·507014 | 1965 | 11·492986 | 8·507238 | 1966 | 11·492762 | 10·000224 | 11 1 | 9·999776 | 38 | 30 |
| 51 | 24 | 8·508974 | 1955 | 11·491026 | 8·509200 | 1958 | 11·490800 | 10·000226 | 12 1 | 9·999774 | 36 | 9 |
| 30 | 26 | 8·510925 | 1947 | 11·489075 | 8·511153 | 1949 | 11·488847 | 10·000228 | 13 1 | 9·999772 | 34 | 30 |
| 52 | 28 | 8·512867 | 1938 | 11·487133 | 8·513098 | 1940 | 11·486902 | 10·000231 | 14 1 | 9·999769 | 32 | 8 |
| 30 | 30 | 8·514801 | 1930 | 11·485199 | 8·515034 | 1931 | 11·484966 | 10·000233 | 15 1 | 9·999767 | 30 | 30 |
| 53 | 32 | 8·516726 | 1921 | 11·483274 | 8·516961 | 1923 | 11·483039 | 10·000235 | 16 1 | 9·999765 | 28 | 7 |
| 30 | 34 | 8·518643 | 1912 | 11·481357 | 8·518880 | 1915 | 11·481120 | 10·000237 | 17 1 | 9·999763 | 26 | 30 |
| 54 | 36 | 8·520551 | 1904 | 11·479449 | 8·520790 | 1906 | 11·479210 | 10·000239 | 18 1 | 9·999761 | 24 | 6 |
| 30 | 38 | 8·522451 | 1896 | 11·477549 | 8·522692 | 1898 | 11·477308 | 10·000241 | 19 1 | 9·999759 | 22 | 30 |
| 55 | 40 | 8·524343 | 1888 | 11·475657 | 8·524586 | 1890 | 11·475414 | 10·000243 | 20 1 | 9·999757 | 20 | 5 |
| 30 | 42 | 8·526226 | 1879 | 11·473774 | 8·526472 | 1881 | 11·473528 | 10·000245 | 21 1 | 9·999755 | 18 | 30 |
| 56 | 44 | 8·528102 | 1871 | 11·471898 | 8·528349 | 1874 | 11·471651 | 10·000247 | 22 2 | 9·999753 | 16 | 4 |
| 30 | 46 | 8·529969 | 1864 | 11·470031 | 8·530218 | 1865 | 11·469782 | 10·000249 | 23 2 | 9·999751 | 14 | 30 |
| 57 | 48 | 8·531828 | 1855 | 11·468172 | 8·532080 | 1857 | 11·467920 | 10·000252 | 24 2 | 9·999748 | 12 | 3 |
| 30 | 50 | 8·533679 | 1847 | 11·466321 | 8·533933 | 1850 | 11·466067 | 10·000254 | 25 2 | 9·999746 | 10 | 30 |
| 58 | 52 | 8·535523 | 1840 | 11·464477 | 8·535779 | 1842 | 11·464221 | 10·000256 | 26 2 | 9·999744 | 8 | 2 |
| 30 | 54 | 8·537358 | 1831 | 11·462642 | 8·537617 | 1834 | 11·462383 | 10·000258 | 27 2 | 9·999742 | 6 | 30 |
| 59 | 56 | 8·539186 | 1824 | 11·460814 | 8·539447 | 1826 | 11·460553 | 10·000260 | 28 2 | 9·999740 | 4 | 1 |
| 30 | 58 | 8·541007 | 1817 | 11·458993 | 8·541269 | 1818 | 11·458731 | 10·000262 | 29 2 | 9·999738 | 2 | 30 |
| 60 | **8** | 8·542819 | 1809 | 11·457181 | 8·543084 | 1811 | 11·456916 | 10·000265 | 30 2 | 9·999735 | 0 | 0 |
| ′ ″ | m. s. | Cosine | D. | Secant | Cotang. | D. | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

88° — $5^h\ 52^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$0^h\ 8^m$ 2°

| ′ ″ | m. | Sine | D. | Cosec. | Tangent | D. | Cotang. | Secant | Parts | Cosine | m. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 8·542819 | 1809 | 11·457181 | 8·543084 | 1811 | 11·456916 | 10·000265 | | 9·999735 | 52 | 60 |
| 30 | 2 | 8·544624 | 1801 | 11·455376 | 8·544891 | 1804 | 11·455109 | 10·000267 | 1″ 0 | 9·999733 | 58 | 30 |
| 1 | 4 | 8·546422 | 1794 | 11·453578 | 8·546691 | 1796 | 11·453309 | 10·000269 | 2 0 | 9·999731 | 56 | 59 |
| 30 | 6 | 8·548212 | 1786 | 11·451788 | 8·548483 | 1789 | 11·451517 | 10·000271 | 3 0 | 9·999729 | 54 | 30 |
| 2 | 8 | 8·549995 | 1779 | 11·450005 | 8·550268 | 1781 | 11·449732 | 10·000274 | 4 0 | 9·999726 | 52 | 58 |
| 30 | 10 | 8·551770 | 1772 | 11·448230 | 8·552046 | 1774 | 11·447954 | 10·000276 | 5 0 | 9·999724 | 50 | 30 |
| 3 | 12 | 8·553539 | 1765 | 11·446461 | 8·553817 | 1767 | 11·446183 | 10·000278 | 6 0 | 9·999722 | 48 | 57 |
| 30 | 14 | 8·555300 | 1758 | 11·444700 | 8·555580 | 1760 | 11·444420 | 10·000280 | 7 1 | 9·999720 | 46 | 30 |
| 4 | 16 | 8·557054 | 1750 | 11·442946 | 8·557336 | 1753 | 11·442664 | 10·000283 | 8 1 | 9·999717 | 44 | 56 |
| 30 | 18 | 8·558801 | 1743 | 11·441199 | 8·559085 | 1745 | 11·440915 | 10·000285 | 9 1 | 9·999715 | 42 | 30 |
| 5 | 20 | 8·560540 | 1737 | 11·439460 | 8·560828 | 1739 | 11·439172 | 10·000287 | 10 1 | 9·999713 | 40 | 55 |
| 30 | 22 | 8·562273 | 1729 | 11·437727 | 8·562563 | 1732 | 11·437437 | 10·000289 | 11 1 | 9·999711 | 38 | 30 |
| 6 | 24 | 8·563999 | 1723 | 11·436001 | 8·564291 | 1725 | 11·435709 | 10·000292 | 12 1 | 9·999708 | 36 | 54 |
| 30 | 26 | 8·565719 | 1716 | 11·434281 | 8·566013 | 1718 | 11·433987 | 10·000294 | 13 1 | 9·999706 | 34 | 30 |
| 7 | 28 | 8·567431 | 1709 | 11·432569 | 8·567727 | 1711 | 11·432273 | 10·000296 | 14 1 | 9·999704 | 32 | 53 |
| 30 | 30 | 8·569137 | 1702 | 11·430863 | 8·569435 | 1705 | 11·430565 | 10·000299 | 15 1 | 9·999701 | 30 | 30 |
| 8 | 32 | 8·570836 | 1696 | 11·429164 | 8·571137 | 1698 | 11·428863 | 10·000301 | 16 1 | 9·999699 | 28 | 52 |
| 38 | 34 | 8·572528 | 1689 | 11·427472 | 8·572832 | 1692 | 11·427168 | 10·000304 | 17 1 | 9·999696 | 26 | 30 |
| 9 | 36 | 8·574214 | 1682 | 11·425786 | 8·574520 | 1684 | 11·425480 | 10·000306 | 18 1 | 9·999694 | 24 | 51 |
| 30 | 38 | 8·575893 | 1676 | 11·424107 | 8·576201 | 1679 | 11·423799 | 10·000308 | 19 1 | 9·999692 | 22 | 30 |
| 10 | 40 | 8·577566 | 1670 | 11·422434 | 8·577877 | 1672 | 11·422123 | 10·000311 | 20 2 | 9·999689 | 20 | 50 |
| 30 | 42 | 8·579232 | 1663 | 11·420768 | 8·579545 | 1665 | 11·420455 | 10·000313 | 21 2 | 9·999687 | 18 | 30 |
| 11 | 44 | 8·580892 | 1657 | 11·419108 | 8·581208 | 1660 | 11·418792 | 10·000315 | 22 2 | 9·999685 | 16 | 49 |
| 30 | 46 | 8·582546 | 1650 | 11·417454 | 8·582864 | 1652 | 11·417136 | 10·000318 | 23 2 | 9·999682 | 14 | 30 |
| 12 | 48 | 8·584193 | 1645 | 11·415807 | 8·584514 | 1647 | 11·415486 | 10·000320 | 24 2 | 9·999680 | 12 | 48 |
| 30 | 50 | 8·585834 | 1638 | 11·414166 | 8·586157 | 1641 | 11·413843 | 10·000323 | 25 2 | 9·999677 | 10 | 30 |
| 13 | 52 | 8·587469 | 1632 | 11·412531 | 8·587795 | 1634 | 11·412205 | 10·000325 | 26 2 | 9·999675 | 8 | 47 |
| 30 | 54 | 8·589098 | 1625 | 11·410902 | 8·589426 | 1628 | 11·410574 | 10·000328 | 27 2 | 9·999672 | 6 | 30 |
| 14 | 56 | 8·590721 | 1620 | 11·409279 | 8·591051 | 1622 | 11·408949 | 10·000330 | 28 2 | 9·999670 | 4 | 46 |
| 30 | 58 | 8·592338 | 1614 | 11·407662 | 8·592670 | 1616 | 11·407330 | 10·000332 | 29 2 | 9·999668 | 2 | 30 |
| 15 | **9** | 8·593948 | 1607 | 11·406052 | 8·594283 | 1611 | 11·405717 | 10·000335 | 30 2 | 9·999665 | **51** | 45 |
| 30 | 2 | 8·595553 | 1602 | 11·404447 | 8·595890 | 1604 | 11·404110 | 10·000337 | 1 0 | 9·999663 | 58 | 30 |
| 16 | 4 | 8·597152 | 1596 | 11·402848 | 8·597492 | 1598 | 11·402508 | 10·000340 | 2 0 | 9·999660 | 56 | 44 |
| 30 | 6 | 8·598745 | 1590 | 11·401255 | 8·599087 | 1593 | 11·400913 | 10·000342 | 3 0 | 9·999658 | 54 | 30 |
| 17 | 8 | 8·600332 | 1584 | 11·399668 | 8·600677 | 1586 | 11·399323 | 10·000345 | 4 0 | 9·999655 | 52 | 43 |
| 30 | 10 | 8·601913 | 1579 | 11·398087 | 8·602260 | 1581 | 11·397740 | 10·000347 | 5 0 | 9·999653 | 50 | 30 |
| 18 | 12 | 8·603489 | 1572 | 11·396511 | 8·603839 | 1576 | 11·396161 | 10·000350 | 6 1 | 9·999650 | 48 | 42 |
| 30 | 14 | 8·605058 | 1567 | 11·394942 | 8·605411 | 1569 | 11·394589 | 10·000353 | 7 1 | 9·999647 | 46 | 30 |
| 19 | 16 | 8·606623 | 1562 | 11·393377 | 8·606978 | 1564 | 11·393022 | 10·000355 | 8 1 | 9·999645 | 44 | 41 |
| 30 | 18 | 8·608181 | 1555 | 11·391819 | 8·608539 | 1558 | 11·391461 | 10·000358 | 9 1 | 9·999642 | 42 | 30 |
| 20 | 20 | 8·609734 | 1551 | 11·390266 | 8·610094 | 1553 | 11·389906 | 10·000360 | 10 1 | 9·999640 | 40 | 40 |
| 30 | 22 | 8·611282 | 1544 | 11·388718 | 8·611644 | 1547 | 11·388356 | 10·000363 | 11 1 | 9·999637 | 38 | 30 |
| 21 | 24 | 8·612823 | 1539 | 11·387177 | 8·613189 | 1542 | 11·386811 | 10·000365 | 12 1 | 9·999635 | 36 | 39 |
| 30 | 26 | 8·614360 | 1534 | 11·385640 | 8·614728 | 1536 | 11·385272 | 10·000368 | 13 1 | 9·999632 | 34 | 30 |
| 22 | 28 | 8·615891 | 1529 | 11·384109 | 8·616262 | 1531 | 11·383738 | 10·000371 | 14 1 | 9·999629 | 32 | 38 |
| 30 | 30 | 8·617417 | 1522 | 11·382583 | 8·617790 | 1526 | 11·382210 | 10·000373 | 15 1 | 9·999627 | 30 | 30 |
| 23 | 32 | 8·618937 | 1518 | 11·381063 | 8·619313 | 1520 | 11·380687 | 10·000376 | 16 1 | 9·999624 | 28 | 37 |
| 30 | 34 | 8·620452 | 1512 | 11·379548 | 8·620830 | 1515 | 11·379170 | 10·000378 | 17 2 | 9·999622 | 26 | 30 |
| 24 | 36 | 8·621962 | 1508 | 11·378038 | 8·622343 | 1510 | 11·377657 | 10·000381 | 18 2 | 9·999619 | 24 | 36 |
| 30 | 38 | 8·623466 | 1501 | 11·376534 | 8·623850 | 1505 | 11·376150 | 10·000384 | 19 2 | 9·999616 | 22 | 30 |
| 25 | 40 | 8·624965 | 1497 | 11·375035 | 8·625352 | 1499 | 11·374648 | 10·000386 | 20 2 | 9·999614 | 20 | 35 |
| 30 | 42 | 8·626459 | 1492 | 11·373541 | 8·626849 | 1494 | 11·373151 | 10·000389 | 21 2 | 9·999611 | 18 | 30 |
| 26 | 44 | 8·627948 | 1486 | 11·372052 | 8·628340 | 1489 | 11·371660 | 10·000392 | 22 2 | 9·999608 | 16 | 34 |
| 30 | 46 | 8·629432 | 1481 | 11·370568 | 8·629827 | 1484 | 11·370173 | 10·000394 | 23 2 | 9·999606 | 14 | 30 |
| 27 | 48 | 8·630911 | 1477 | 11·369089 | 8·631308 | 1479 | 11·368692 | 10·000397 | 24 2 | 9·999603 | 12 | 33 |
| 30 | 50 | 8·632385 | 1471 | 11·367615 | 8·632785 | 1474 | 11·367215 | 10·000400 | 25 2 | 9·999600 | 10 | 30 |
| 28 | 52 | 8·633854 | 1466 | 11·366146 | 8·634256 | 1469 | 11·365744 | 10·000403 | 26 2 | 9·999597 | 8 | 32 |
| 30 | 54 | 8·635317 | 1462 | 11·364683 | 8·635723 | 1464 | 11·364277 | 10·000405 | 27 2 | 9·999595 | 6 | 30 |
| 29 | 56 | 8·636776 | 1456 | 11·363224 | 8·637184 | 1459 | 11·362816 | 10·000408 | 28 3 | 9·999592 | 4 | 31 |
| 30 | 58 | 8·638230 | 1452 | 11·361770 | 8·638641 | 1455 | 11·361359 | 10·000411 | 29 3 | 9·999589 | 2 | 30 |
| 30 | **10** | 8·639680 | 1446 | 11·360320 | 8·640093 | 1449 | 11·359907 | 10·000414 | 30 3 | 9·999586 | 0 | 30 |
| ′ ″ | m. | Cosine | D. | Secant | Cotang. | D. | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |

87° $5^h\ 50^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0h 10m — 2°

| ′ ″ | m. s. | Sine | D. | Cosec. | Tangent | D. | Cotang. | Secant | Parts | Cosine | m | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 8·639680 | 1446 | 11·360320 | 8·640093 | 1449 | 11·359907 | 10·000414 | | 9·999586 | **50** | 30 |
| 30 | 2 | 8·641124 | 1442 | 11·358876 | 8·641540 | 1445 | 11·358460 | 10·000416 | 1″ 0 | 9·999584 | 58 | 30 |
| 31 | 4 | 8·642563 | 1437 | 11·357437 | 8·642982 | 1440 | 11·357018 | 10·000419 | 2 0 | 9·999581 | 56 | 29 |
| 30 | 6 | 8·643998 | 1433 | 11·356002 | 8·644420 | 1435 | 11·355580 | 10·000422 | 3 0 | 9·999578 | 54 | 30 |
| 32 | 8 | 8·645428 | 1427 | 11·354572 | 8·645853 | 1431 | 11·354147 | 10·000425 | 4 0 | 9·999575 | 52 | 28 |
| 30 | 10 | 8·646854 | 1423 | 11·353146 | 8·647281 | 1425 | 11·352719 | 10·000427 | 5 0 | 9·999573 | 50 | 30 |
| 33 | 12 | 8·648274 | 1419 | 11·351726 | 8·648704 | 1421 | 11·351296 | 10·000430 | 6 1 | 9·999570 | 48 | 27 |
| 30 | 14 | 8·649690 | 1413 | 11·350310 | 8·650123 | 1417 | 11·349877 | 10·000433 | 7 1 | 9·999567 | 46 | 30 |
| 34 | 16 | 8·651102 | 1410 | 11·348898 | 8·651537 | 1412 | 11·348463 | 10·000436 | 8 1 | 9·999564 | 44 | 26 |
| 30 | 18 | 8·652508 | 1404 | 11·347492 | 8·652947 | 1407 | 11·347053 | 10·000439 | 9 1 | 9·999561 | 42 | 30 |
| 35 | 20 | 8·653911 | 1400 | 11·346089 | 8·654352 | 1403 | 11·345648 | 10·000442 | 10 1 | 9·999558 | 40 | 25 |
| 30 | 22 | 8·655308 | 1396 | 11·344692 | 8·655753 | 1399 | 11·344247 | 10·000444 | 11 1 | 9·999556 | 38 | 30 |
| 36 | 24 | 8·656702 | 1391 | 11·343298 | 8·657149 | 1393 | 11·342851 | 10·000447 | 12 1 | 9·999553 | 36 | 24 |
| 30 | 26 | 8·658090 | 1386 | 11·341910 | 8·658541 | 1390 | 11·341459 | 10·000450 | 13 1 | 9·999550 | 34 | 30 |
| 37 | 28 | 8·659475 | 1382 | 11·340525 | 8·659928 | 1385 | 11·340072 | 10·000453 | 14 1 | 9·999547 | 32 | 23 |
| 30 | 30 | 8·660855 | 1378 | 11·339145 | 8·661311 | 1381 | 11·338689 | 10·000456 | 15 1 | 9·999544 | 30 | 30 |
| 38 | 32 | 8·662230 | 1373 | 11·337770 | 8·662689 | 1376 | 11·337311 | 10·000459 | 16 2 | 9·999541 | 28 | 22 |
| 30 | 34 | 8·663602 | 1370 | 11·336398 | 8·664063 | 1372 | 11·335937 | 10·000462 | 17 2 | 9·999538 | 26 | 30 |
| 39 | 36 | 8·664968 | 1364 | 11·335032 | 8·665433 | 1367 | 11·334567 | 10·000465 | 18 2 | 9·999535 | 24 | 21 |
| 30 | 38 | 8·666331 | 1361 | 11·333669 | 8·666799 | 1364 | 11·333201 | 10·000468 | 19 2 | 9·999532 | 22 | 30 |
| 40 | 40 | 8·667689 | 1356 | 11·332311 | 8·668160 | 1359 | 11·331840 | 10·000471 | 20 2 | 9·999529 | 20 | 20 |
| 30 | 42 | 8·669043 | 1352 | 11·330957 | 8·669517 | 1355 | 11·330483 | 10·000473 | 21 2 | 9·999527 | 18 | 30 |
| 41 | 44 | 8·670393 | 1348 | 11·329607 | 8·670870 | 1351 | 11·329130 | 10·000476 | 22 2 | 9·999524 | 16 | 19 |
| 30 | 46 | 8·671739 | 1343 | 11·328261 | 8·672218 | 1346 | 11·327782 | 10·000479 | 23 2 | 9·999521 | 14 | 30 |
| 42 | 48 | 8·673080 | 1340 | 11·326920 | 8·673563 | 1343 | 11·326437 | 10·000482 | 24 2 | 9·999518 | 12 | 18 |
| 30 | 50 | 8·674418 | 1335 | 11·325582 | 8·674903 | 1338 | 11·325097 | 10·000485 | 25 2 | 9·999515 | 10 | 30 |
| 43 | 52 | 8·675751 | 1331 | 11·324249 | 8·676239 | 1334 | 11·323761 | 10·000488 | 26 3 | 9·999512 | 8 | 17 |
| 30 | 54 | 8·677080 | 1327 | 11·322920 | 8·677572 | 1330 | 11·322428 | 10·000491 | 27 3 | 9·999509 | 6 | 30 |
| 44 | 56 | 8·678405 | 1323 | 11·321595 | 8·678900 | 1326 | 11·321100 | 10·000494 | 28 3 | 9·999506 | 4 | 6 |
| 30 | 58 | 8·679726 | 1319 | 11·320274 | 8·680224 | 1322 | 11·319776 | 10·000497 | 29 3 | 9·999503 | 2 | 30 |
| 45 | **11** | 8·681043 | 1315 | 11·318957 | 8·681544 | 1318 | 11·318456 | 10·000500 | 30 3 | 9·999500 | **49** | 15 |
| 30 | 2 | 8·682356 | 1311 | 11·317644 | 8·682860 | 1314 | 11·317140 | 10·000503 | 1 0 | 9·999497 | 58 | 30 |
| 46 | 4 | 8·683665 | 1308 | 11·316335 | 8·684172 | 1311 | 11·315828 | 10·000507 | 2 0 | 9·999493 | 56 | 14 |
| 30 | 6 | 8·684971 | 1303 | 11·315029 | 8·685480 | 1306 | 11·314520 | 10·000510 | 3 0 | 9·999490 | 54 | 30 |
| 47 | 8 | 8·686272 | 1299 | 11·313728 | 8·686784 | 1302 | 11·313216 | 10·000513 | 4 0 | 9·999487 | 52 | 13 |
| 30 | 10 | 8·687569 | 1295 | 11·312431 | 8·688085 | 1299 | 11·311915 | 10·000516 | 5 1 | 9·999484 | 50 | 30 |
| 48 | 12 | 8·688863 | 1292 | 11·311137 | 8·689381 | 1294 | 11·310619 | 10·000519 | 6 1 | 9·999481 | 48 | 12 |
| 30 | 14 | 8·690152 | 1288 | 11·309848 | 8·690674 | 1291 | 11·309326 | 10·000522 | 7 1 | 9·999478 | 46 | 30 |
| 49 | 16 | 8·691438 | 1283 | 11·308562 | 8·691963 | 1287 | 11·308037 | 10·000525 | 8 1 | 9·999475 | 44 | 11 |
| 30 | 18 | 8·692720 | 1280 | 11·307280 | 8·693248 | 1283 | 11·306752 | 10·000528 | 9 1 | 9·999472 | 42 | 30 |
| 50 | 20 | 8·693998 | 1277 | 11·306002 | 8·694529 | 1280 | 11·305471 | 10·000531 | 10 1 | 9·999469 | 40 | 10 |
| 30 | 22 | 8·695272 | 1272 | 11·304728 | 8·695807 | 1275 | 11·304193 | 10·000534 | 11 1 | 9·999466 | 38 | 30 |
| 51 | 24 | 8·696543 | 1269 | 11·303457 | 8·697081 | 1272 | 11·302919 | 10·000537 | 12 1 | 9·999463 | 36 | 9 |
| 30 | 26 | 8·697810 | 1265 | 11·302190 | 8·698351 | 1268 | 11·301649 | 10·000541 | 13 1 | 9·999459 | 34 | 30 |
| 52 | 28 | 8·699073 | 1262 | 11·300927 | 8·699617 | 1265 | 11·300383 | 10·000544 | 14 1 | 9·999456 | 32 | 8 |
| 30 | 30 | 8·700333 | 1257 | 11·299667 | 8·700880 | 1261 | 11·299120 | 10·000547 | 15 2 | 9·999453 | 30 | 30 |
| 53 | 32 | 8·701589 | 1255 | 11·298411 | 8·702139 | 1257 | 11·297861 | 10·000550 | 16 2 | 9·999450 | 28 | 7 |
| 30 | 34 | 8·702841 | 1250 | 11·297159 | 8·703395 | 1254 | 11·296605 | 10·000553 | 17 2 | 9·999447 | 26 | 30 |
| 54 | 36 | 8·704090 | 1247 | 11·295910 | 8·704646 | 1250 | 11·295354 | 10·000557 | 18 2 | 9·999443 | 24 | 6 |
| 30 | 38 | 8·705335 | 1243 | 11·294665 | 8·705895 | 1247 | 11·294105 | 10·000560 | 19 2 | 9·999440 | 22 | 30 |
| 55 | 40 | 8·706577 | 1240 | 11·293423 | 8·707140 | 1243 | 11·292860 | 10·000563 | 20 2 | 9·999437 | 20 | 5 |
| 30 | 42 | 8·707815 | 1236 | 11·292185 | 8·708381 | 1239 | 11·291619 | 10·000566 | 21 2 | 9·999434 | 18 | 30 |
| 56 | 44 | 8·709049 | 1233 | 11·290951 | 8·709618 | 1236 | 11·290382 | 10·000569 | 22 2 | 9·999431 | 16 | 4 |
| 30 | 46 | 8·710280 | 1229 | 11·289720 | 8·710853 | 1233 | 11·289147 | 10·000573 | 23 2 | 9·999427 | 14 | 30 |
| 57 | 48 | 8·711507 | 1226 | 11·288493 | 8·712083 | 1228 | 11·287917 | 10·000576 | 24 2 | 9·999424 | 12 | 3 |
| 30 | 50 | 8·712731 | 1222 | 11·287268 | 8·713311 | 1226 | 11·286689 | 10·000579 | 25 3 | 9·999421 | 10 | 30 |
| 58 | 52 | 8·713952 | 1219 | 11·286048 | 8·714534 | 1222 | 11·285466 | 10·000582 | 26 3 | 9·999418 | 8 | 2 |
| 30 | 54 | 8·715169 | 1216 | 11·284831 | 8·715755 | 1219 | 11·284245 | 10·000586 | 27 3 | 9·999414 | 6 | 30 |
| 59 | 56 | 8·716383 | 1212 | 11·283617 | 8·716972 | 1215 | 11·283028 | 10·000589 | 28 3 | 9·999411 | 4 | 1 |
| 30 | 58 | 8·717593 | 1208 | 11·282406 | 8·718186 | 1212 | 11·281814 | 10·000592 | 29 3 | 9·999408 | 2 | 30 |
| 60 | **12** | 8·718800 | 1205 | 11·281200 | 8·719396 | 1209 | 11·280604 | 10·000596 | 30 3 | 9·999404 | 0 | 0 |
| ′ ″ | m. s. | Cosine | D. | Secant | Cotang. | D. | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

87° — 5h 48m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

$0^h\ 12^m$ — 3°

| ′ ″ | m. s. | Sine | D. | Cosec. | Tangent | D. | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 8·718800 | 1205 | 11·281200 | 8·719396 | 1209 | 11·280604 | 10·000596 | | 9·999404 | 48 | 60 |
| 30 | 2 | 8·720004 | 1202 | 11·279996 | 8·720603 | 1205 | 11·279397 | 10·000599 | 1″ 0 | 9·999401 | 58 | 30 |
| 1 | 4 | 8·721204 | 1199 | 11·278796 | 8·721806 | 1202 | 11·278194 | 10·000602 | 2 0 | 9·999398 | 56 | 59 |
| 30 | 6 | 8·722401 | 1195 | 11·277599 | 8·723007 | 1198 | 11·276993 | 10·000606 | 3 0 | 9·999394 | 54 | 30 |
| 2 | 8 | 8·723595 | 1192 | 11·276405 | 8·724204 | 1196 | 11·275796 | 10·000609 | 4 0 | 9·999391 | 52 | 58 |
| 30 | 10 | 8·724785 | 1189 | 11·275215 | 8·725397 | 1192 | 11·274603 | 10·000612 | 5 1 | 9·999388 | 50 | 30 |
| 3 | 12 | 8·725972 | 1185 | 11·274028 | 8·726588 | 1189 | 11·273412 | 10·000616 | 6 1 | 9·999384 | 48 | 57 |
| 30 | 14 | 8·727156 | 1183 | 11·272844 | 8·727775 | 1185 | 11·272225 | 10·000619 | 7 1 | 9·999381 | 46 | 30 |
| 4 | 16 | 8·728337 | 1179 | 11·271663 | 8·728959 | 1183 | 11·271041 | 10·000622 | 8 1 | 9·999378 | 44 | 56 |
| 30 | 18 | 8·729514 | 1176 | 11·270486 | 8·730140 | 1179 | 11·269860 | 10·000626 | 9 1 | 9·999374 | 42 | 30 |
| 5 | 20 | 8·730688 | 1172 | 11·269312 | 8·731317 | 1176 | 11·268683 | 10·000629 | 10 1 | 9·999371 | 40 | 55 |
| 30 | 22 | 8·731859 | 1170 | 11·268141 | 8·732492 | 1173 | 11·267508 | 10·000633 | 11 1 | 9·999367 | 38 | 30 |
| 6 | 24 | 8·733027 | 1166 | 11·266973 | 8·733663 | 1170 | 11·266337 | 10·000636 | 12 1 | 9·999364 | 36 | 54 |
| 30 | 26 | 8·734192 | 1163 | 11·265808 | 8·734831 | 1166 | 11·265169 | 10·000639 | 13 1 | 9·999361 | 34 | 30 |
| 7 | 28 | 8·735354 | 1160 | 11·264646 | 8·735996 | 1164 | 11·264004 | 10·000643 | 14 2 | 9·999357 | 32 | 53 |
| 30 | 30 | 8·736512 | 1157 | 11·263488 | 8·737158 | 1160 | 11·262842 | 10·000646 | 15 2 | 9·999354 | 30 | 30 |
| 8 | 32 | 8·737667 | 1154 | 11·262333 | 8·738317 | 1158 | 11·261683 | 10·000650 | 16 2 | 9·999350 | 28 | 52 |
| 30 | 34 | 8·738820 | 1151 | 11·261180 | 8·739473 | 1154 | 11·260527 | 10·000653 | 17 2 | 9·999347 | 26 | 30 |
| 9 | 36 | 8·739969 | 1148 | 11·260031 | 8·740626 | 1151 | 11·259374 | 10·000657 | 18 2 | 9·999343 | 24 | 51 |
| 30 | 38 | 8·741115 | 1144 | 11·258885 | 8·741776 | 1148 | 11·258224 | 10·000660 | 19 2 | 9·999340 | 22 | 30 |
| 10 | 40 | 8·742259 | 1142 | 11·257741 | 8·742922 | 1146 | 11·257078 | 10·000664 | 20 2 | 9·999336 | 20 | 30 |
| 30 | 42 | 8·743399 | 1139 | 11·256601 | 8·744066 | 1142 | 11·255934 | 10·000667 | 21 2 | 9·999333 | 18 | 30 |
| 11 | 44 | 8·744536 | 1136 | 11·255464 | 8·745207 | 1139 | 11·254793 | 10·000671 | 22 3 | 9·999329 | 16 | 40 |
| 30 | 46 | 8·745670 | 1132 | 11·254330 | 8·746344 | 1136 | 11·253656 | 10·000674 | 23 3 | 9·999326 | 14 | 30 |
| 12 | 48 | 8·746802 | 1130 | 11·253198 | 8·747479 | 1134 | 11·252521 | 10·000678 | 24 3 | 9·999322 | 12 | 48 |
| 30 | 50 | 8·747930 | 1127 | 11·252070 | 8·748611 | 1130 | 11·251389 | 10·000681 | 25 3 | 9·999319 | 10 | 30 |
| 13 | 52 | 8·749055 | 1124 | 11·250945 | 8·749740 | 1127 | 11·250260 | 10·000685 | 26 3 | 9·999315 | 8 | 47 |
| 30 | 54 | 8·750178 | 1121 | 11·249822 | 8·750866 | 1125 | 11·249134 | 10·000688 | 27 3 | 9·999312 | 6 | 30 |
| 14 | 56 | 8·751297 | 1118 | 11·248703 | 8·751989 | 1122 | 11·248011 | 10·000692 | 28 3 | 9·999308 | 4 | 46 |
| 30 | 58 | 8·752414 | 1115 | 11·247586 | 8·753109 | 1119 | 11·246891 | 10·000695 | 29 3 | 9·999305 | 2 | 30 |
| 15 | 13 | 8·753528 | 1113 | 11·246472 | 8·754227 | 1116 | 11·245773 | 10·000699 | 30 3 | 9·999301 | 47 | 45 |
| 30 | 2 | 8·754639 | 1109 | 11·245361 | 8·755341 | 1113 | 11·244659 | 10·000703 | 1 0 | 9·999297 | 58 | 30 |
| 16 | 4 | 8·755747 | 1107 | 11·244253 | 8·756453 | 1110 | 11·243547 | 10·000706 | 2 0 | 9·999294 | 56 | 44 |
| 30 | 6 | 8·756852 | 1104 | 11·243148 | 8·757562 | 1107 | 11·242438 | 10·000710 | 3 0 | 9·999290 | 54 | 30 |
| 17 | 8 | 8·757955 | 1101 | 11·242045 | 8·758668 | 1105 | 11·241332 | 10·000713 | 4 0 | 9·999287 | 52 | 43 |
| 30 | 10 | 8·759054 | 1098 | 11·240946 | 8·759771 | 1102 | 11·240229 | 10·000717 | 5 1 | 9·999283 | 50 | 30 |
| 18 | 12 | 8·760151 | 1096 | 11·239849 | 8·760872 | 1099 | 11·239128 | 10·000721 | 6 1 | 9·999279 | 48 | 42 |
| 30 | 14 | 8·761245 | 1092 | 11·238755 | 8·761970 | 1097 | 11·238030 | 10·000724 | 7 1 | 9·999276 | 46 | 30 |
| 19 | 16 | 8·762337 | 1090 | 11·237663 | 8·763065 | 1093 | 11·236935 | 10·000728 | 8 1 | 9·999272 | 44 | 41 |
| 30 | 18 | 8·763425 | 1088 | 11·236575 | 8·764157 | 1091 | 11·235843 | 10·000732 | 9 1 | 9·999268 | 42 | 30 |
| 20 | 20 | 8·764511 | 1084 | 11·235489 | 8·765246 | 1088 | 11·234754 | 10·000735 | 10 1 | 9·999265 | 40 | 40 |
| 30 | 22 | 8·765594 | 1082 | 11·234406 | 8·766333 | 1086 | 11·233667 | 10·000739 | 11 1 | 9·999261 | 38 | 30 |
| 21 | 24 | 8·766675 | 1079 | 11·233325 | 8·767417 | 1083 | 11·232583 | 10·000743 | 12 1 | 9·999257 | 36 | 39 |
| 30 | 26 | 8·767752 | 1076 | 11·232248 | 8·768499 | 1080 | 11·231501 | 10·000746 | 13 2 | 9·999254 | 34 | 30 |
| 22 | 28 | 8·768828 | 1074 | 11·231172 | 8·769578 | 1077 | 11·230422 | 10·000750 | 14 2 | 9·999250 | 32 | 38 |
| 30 | 30 | 8·769900 | 1071 | 11·230100 | 8·770654 | 1075 | 11·229346 | 10·000754 | 15 2 | 9·999246 | 30 | 30 |
| 23 | 32 | 8·770970 | 1069 | 11·229030 | 8·771727 | 1072 | 11·228273 | 10·000758 | 16 2 | 9·999242 | 28 | 37 |
| 30 | 34 | 8·772037 | 1065 | 11·227963 | 8·772798 | 1070 | 11·227202 | 10·000761 | 17 2 | 9·999239 | 26 | 30 |
| 24 | 36 | 8·773101 | 1064 | 11·226899 | 8·773866 | 1067 | 11·226134 | 10·000765 | 18 2 | 9·999235 | 24 | 36 |
| 30 | 38 | 8·774163 | 1060 | 11·225837 | 8·774932 | 1064 | 11·225068 | 10·000769 | 19 2 | 9·999231 | 22 | 30 |
| 25 | 40 | 8·775223 | 1058 | 11·224777 | 8·775995 | 1062 | 11·224005 | 10·000773 | 20 2 | 9·999227 | 20 | 35 |
| 30 | 42 | 8·776279 | 1056 | 11·223721 | 8·777056 | 1059 | 11·222944 | 10·000776 | 21 3 | 9·999224 | 18 | 30 |
| 26 | 44 | 8·777333 | 1053 | 11·222667 | 8·778114 | 1057 | 11·221886 | 10·000780 | 22 3 | 9·999220 | 16 | 34 |
| 30 | 46 | 8·778385 | 1050 | 11·221615 | 8·779169 | 1054 | 11·220831 | 10·000784 | 23 3 | 9·999216 | 14 | 30 |
| 27 | 48 | 8·779434 | 1048 | 11·220566 | 8·780222 | 1051 | 11·219778 | 10·000788 | 24 3 | 9·999212 | 12 | 33 |
| 30 | 50 | 8·780480 | 1045 | 11·219520 | 8·781272 | 1049 | 11·218728 | 10·000792 | 25 3 | 9·999208 | 10 | 30 |
| 28 | 52 | 8·781524 | 1043 | 11·218476 | 8·782320 | 1047 | 11·217680 | 10·000795 | 26 3 | 9·999205 | 8 | 32 |
| 30 | 54 | 8·782566 | 1040 | 11·217434 | 8·783365 | 1044 | 11·216635 | 10·000799 | 27 3 | 9·999201 | 6 | 30 |
| 29 | 56 | 8·783605 | 1037 | 11·216395 | 8·784408 | 1041 | 11·215592 | 10·000803 | 28 3 | 9·999197 | 4 | 31 |
| 30 | 58 | 8·784641 | 1036 | 11·215359 | 8·785448 | 1040 | 11·214552 | 10·000807 | 29 4 | 9·999193 | 2 | 30 |
| 30 | 14 | 8·785675 | 1032 | 11·214325 | 8·786486 | 1036 | 11·213514 | 10·000811 | 30 4 | 9·999189 | 0 | 30 |
| ′ ″ | m. | Cosine | D. | Secant | Cotang. | D. | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

86° — $5^h\ 46^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0h 14m — 3°

| ′ ″ | m. s. | Sine | D. | Cosec. | Tangent | D. | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 8·785675 | 1032 | 11·214325 | 8·786486 | 1036 | 11·213514 | 10·000811 | | 9·999189 | 46 | 30 |
| 30 | 2 | 8·786707 | 1031 | 11·213293 | 8·787521 | 1034 | 11·212479 | 10·000815 | 1″ 0 | 9·999185 | 58 | 30 |
| 31 | 4 | 8·787736 | 1028 | 11·212264 | 8·788554 | 1032 | 11·211446 | 10·000819 | 2 0 | 9·999181 | 56 | 29 |
| 30 | 6 | 8·788762 | 1025 | 11·211238 | 8·789585 | 1029 | 11·210415 | 10·000822 | 3 0 | 9·999178 | 54 | 30 |
| 32 | 8 | 8·789787 | 1023 | 11·210213 | 8·790613 | 1027 | 11·209387 | 10·000826 | 4 1 | 9·999174 | 52 | 28 |
| 30 | 10 | 8·790808 | 1020 | 11·209192 | 8·791639 | 1025 | 11·208361 | 10·000830 | 5 1 | 9·999170 | 50 | 30 |
| 33 | 12 | 8·791828 | 1019 | 11·208172 | 8·792662 | 1022 | 11·207338 | 10·000834 | 6 1 | 9·999166 | 48 | 27 |
| 30 | 14 | 8·792845 | 1015 | 11·207155 | 8·793683 | 1019 | 11·206317 | 10·000838 | 7 1 | 9·999162 | 46 | 30 |
| 34 | 16 | 8·793859 | 1014 | 11·206141 | 8·794701 | 1018 | 11·205299 | 10·000842 | 8 1 | 9·999158 | 44 | 26 |
| 30 | 18 | 8·794872 | 1011 | 11·205128 | 8·795718 | 1015 | 11·204282 | 10·000846 | 9 1 | 9·999154 | 42 | 30 |
| 35 | 20 | 8·795881 | 1009 | 11·204119 | 8·796731 | 1012 | 11·203269 | 10·000850 | 10 1 | 9·999150 | 40 | 25 |
| 30 | 22 | 8·796889 | 1006 | 11·203111 | 8·797743 | 1011 | 11·202257 | 10·000854 | 11 1 | 9·999146 | 38 | 30 |
| 36 | 24 | 8·797894 | 1004 | 11·202106 | 8·798752 | 1008 | 11·201248 | 10·000858 | 12 2 | 9·999142 | 36 | 24 |
| 30 | 26 | 8·798897 | 1001 | 11·201103 | 8·799759 | 1005 | 11·200241 | 10·000862 | 13 2 | 9·999138 | 34 | 30 |
| 37 | 28 | 8·799897 | 1000 | 11 200103 | 8·800763 | 1004 | 11·199237 | 10·000866 | 14 2 | 9·999134 | 32 | 23 |
| 30 | 30 | 8·800896 | 997 | 11·199104 | 8·801765 | 1001 | 11·198235 | 10·000870 | 15 2 | 9·999130 | 30 | 30 |
| 38 | 32 | 8·801892 | 995 | 11·198108 | 8·802765 | 998 | 11·197235 | 10·000874 | 16 2 | 9·999126 | 28 | 22 |
| 30 | 34 | 8·802885 | 992 | 11·197115 | 8·803763 | 997 | 11·196237 | 10·000878 | 17 2 | 9·999122 | 26 | 30 |
| 39 | 36 | 8·803876 | 990 | 11·196124 | 8·804758 | 994 | 11·195242 | 10·000882 | 18 2 | 9·999118 | 24 | 21 |
| 30 | 38 | 8·804866 | 988 | 11·195134 | 8·805751 | 992 | 11·194249 | 10·000886 | 19 3 | 9·999114 | 22 | 30 |
| 40 | 40 | 8·805852 | 986 | 11·194148 | 8·806742 | 990 | 11·193258 | 10·000890 | 20 3 | 9·999110 | 20 | 20 |
| 30 | 42 | 8·806837 | 983 | 11·193163 | 8·807731 | 987 | 11·192269 | 10·000894 | 21 3 | 9·999106 | 18 | 30 |
| 41 | 44 | 8·807819 | 982 | 11·192181 | 8·808717 | 986 | 11 191283 | 10·000898 | 22 3 | 9·999102 | 16 | 19 |
| 30 | 46 | 8·808799 | 979 | 11·191201 | 8·809701 | 983 | 11·190299 | 10·000902 | 23 3 | 9·999098 | 14 | 30 |
| 42 | 48 | 8·809777 | 976 | 11·190223 | 8·810683 | 981 | 11·189317 | 10·000906 | 24 3 | 9·999094 | 12 | 18 |
| 30 | 50 | 8·810753 | 975 | 11·189247 | 8·811663 | 978 | 11·188337 | 10·000910 | 25 3 | 9·999090 | 10 | 30 |
| 43 | 52 | 8·811726 | 972 | 11·188274 | 8·812641 | 977 | 11·187359 | 10·000914 | 26 3 | 9·999086 | 8 | 17 |
| 30 | 54 | 8·812698 | 971 | 11·187302 | 8·813616 | 974 | 11·186384 | 10·000918 | 27 4 | 9·999082 | 6 | 30 |
| 44 | 56 | 8·813667 | 968 | 11·186333 | 8·814589 | 972 | 11·185411 | 10·000923 | 28 4 | 9·999077 | 4 | 16 |
| 30 | 58 | 8·814634 | 965 | 11·185366 | 8·815560 | 970 | 11·184440 | 10·000927 | 29 4 | 9·999073 | 2 | 30 |
| 45 | **15** | 8·815599 | 964 | 11·184401 | 8·816529 | 968 | 11·183471 | 10·000931 | 30 4 | 9·999069 | **45** | 15 |
| 30 | 2 | 8·816561 | 962 | 11·183439 | 8·817496 | 966 | 11·182504 | 10·000935 | 1 0 | 9·999065 | 58 | 30 |
| 46 | 4 | 8·817522 | 959 | 11·182478 | 8·818461 | 963 | 11·181539 | 10·000939 | 2 0 | 9·999061 | 56 | 14 |
| 30 | 6 | 8·818480 | 958 | 11·181520 | 8·819423 | 962 | 11·180577 | 10·000943 | 3 0 | 9·999057 | 54 | 30 |
| 47 | 8 | 8·819436 | 955 | 11·180564 | 8·820384 | 959 | 11·179616 | 10·000947 | 4 1 | 9·999053 | 52 | 13 |
| 30 | 10 | 8·820390 | 953 | 11·179610 | 8·821342 | 958 | 11·178658 | 10·000952 | 5 1 | 9·999048 | 50 | 30 |
| 48 | 12 | 8·821343 | 951 | 11·178657 | 8·822298 | 955 | 11·177702 | 10·000956 | 6 1 | 9·999044 | 48 | 12 |
| 30 | 14 | 8·822292 | 949 | 11·177708 | 8·823253 | 953 | 11·176747 | 10·000960 | 7 1 | 9·999040 | 46 | 30 |
| 49 | 16 | 8·823240 | 947 | 11·176760 | 8·824205 | 951 | 11·175795 | 10·000964 | 8 1 | 9·999036 | 44 | 11 |
| 30 | 18 | 8·824186 | 944 | 11·175814 | 8·825155 | 949 | 11·174845 | 10·000968 | 9 1 | 9·999032 | 42 | 30 |
| 50 | 20 | 8·825130 | 943 | 11·174870 | 8·826103 | 947 | 11·173897 | 10·000973 | 10 1 | 9·999027 | 40 | 10 |
| 30 | 22 | 8·826072 | 941 | 11·173928 | 8·827049 | 945 | 11·172951 | 10·000977 | 11 2 | 9·999023 | 38 | 30 |
| 51 | 24 | 8·827011 | 938 | 11·172989 | 8·827992 | 943 | 11·172008 | 10·000981 | 12 2 | 9·999019 | 36 | 9 |
| 30 | 26 | 8·827949 | 937 | 11·172051 | 8·828934 | 941 | 11·171066 | 10·000985 | 13 2 | 9·999015 | 34 | 30 |
| 52 | 28 | 8·828884 | 934 | 11·171116 | 8·829874 | 938 | 11·170126 | 10·000990 | 14 2 | 9·999010 | 32 | 8 |
| 30 | 30 | 8·829818 | 933 | 11·170182 | 8·830812 | 937 | 11·169188 | 10·000994 | 15 2 | 9·999006 | 30 | 30 |
| 53 | 32 | 8·830749 | 931 | 11·169251 | 8·831748 | 935 | 11·168252 | 10·000998 | 16 2 | 9·999002 | 28 | 7 |
| 30 | 34 | 8·831679 | 928 | 11·168321 | 8·832682 | 933 | 11·167318 | 10·001003 | 17 2 | 9·998997 | 26 | 30 |
| 54 | 36 | 8·832607 | 927 | 11·167393 | 8·833613 | 931 | 11·166387 | 10·001007 | 18 3 | 9·998993 | 24 | 6 |
| 30 | 38 | 8·833[illegible]32 | 924 | 11·166468 | 8·834543 | 929 | 11·165457 | 10·001011 | 19 3 | 9·998989 | 22 | 30 |
| 55 | 40 | 8·834456 | 923 | 11·165544 | 8·835471 | 926 | 11·164529 | 10·001016 | 20 3 | 9·998984 | 20 | 5 |
| 30 | 42 | 8·835377 | 920 | 11·164623 | 8·836397 | 925 | 11·163603 | 10·001020 | 21 3 | 9·998980 | 18 | 30 |
| 56 | 44 | 8·836297 | 919 | 11·163703 | 8·837321 | 923 | 11·162679 | 10·001024 | 22 3 | 9·998976 | 16 | 4 |
| 30 | 46 | 8·837215 | 917 | 11·162785 | 8·838243 | 922 | 11·161757 | 10·001029 | 23 3 | 9·998971 | 14 | 30 |
| 57 | 48 | 8·838130 | 915 | 11·161870 | 8·839163 | 919 | 11·160837 | 10·001033 | 24 3 | 9·998967 | 12 | 3 |
| 30 | 50 | 8·839044 | 912 | 11·160956 | 8 840081 | 917 | 11·159919 | 10·001037 | 25 4 | 9·998963 | 10 | 30 |
| 58 | 52 | 8·839956 | 911 | 11·160044 | 8·840998 | 915 | 11·159002 | 10·001042 | 26 4 | 9·998958 | 8 | 2 |
| 30 | 54 | 8·840866 | 909 | 11·159134 | 8·841912 | 914 | 11·158088 | 10·001046 | 27 4 | 9·998954 | 6 | 30 |
| 59 | 56 | 8·841774 | 907 | 11·158226 | 8·842825 | 911 | 11·157175 | 10·001050 | 28 4 | 9·998950 | 4 | 1 |
| 30 | 58 | 8·842680 | 906 | 11·157320 | 8·843735 | 910 | 11·156265 | 10·001055 | 29 4 | 9·998945 | 2 | 30 |
| 60 | **16** | 8·843585 | 903 | 11·156415 | 8·844644 | 907 | 11·155356 | 10·001059 | 30 4 | 9·998941 | 0 | 0 |
| ′ ″ | m. s. | Cosine | D. | Secant | Cotang. | D | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

86° — 5h 44m

TABLE XXVI.—(continued).

LOG. SINES, COSINES, &c.

0h 16m — 4°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 8·843585 | | 11·156415 | 8·844644 | | 11·155356 | 10·001059 | | 9·998941 | 44 | 60 |
| 30 | 2 | 8·844487 | 1″ 30 | 11·155513 | 8·845551 | 1″ 30 | 11·154449 | 10·001064 | 1″ 0 | 9·998936 | 58 | 30 |
| 1 | 4 | 8·845387 | 2 60 | 11·154613 | 8·846455 | 2 60 | 11·153545 | 10·001068 | 2 0 | 9·998932 | 56 | 59 |
| 30 | 6 | 8·846286 | 3 89 | 11·153714 | 8·847358 | 3 90 | 11·152642 | 10·001073 | 3 0 | 9·998927 | 54 | 30 |
| 2 | 8 | 8·847183 | 4 119 | 11·152817 | 8·848260 | 4 120 | 11·151740 | 10·001077 | 4 1 | 9·998923 | 52 | 58 |
| 30 | 10 | 8·848078 | 5 149 | 11·151922 | 8·849159 | 5 150 | 11·150841 | 10·001081 | 5 1 | 9·998919 | 50 | 30 |
| 3 | 12 | 8·848971 | 6 179 | 11·151029 | 8·850057 | 6 180 | 11·149943 | 10·001086 | 6 1 | 9·998914 | 48 | 57 |
| 30 | 14 | 8·849862 | 7 208 | 11·150138 | 8·850952 | 7 210 | 11·149048 | 10·001090 | 7 1 | 9·998910 | 46 | 30 |
| 4 | 16 | 8·850751 | 8 238 | 11·149249 | 8·851846 | 8 239 | 11·148154 | 10·001095 | 8 1 | 9·998905 | 44 | 56 |
| 30 | 18 | 8·851639 | 9 268 | 11·148361 | 8·852738 | 9 269 | 11·147262 | 10·001099 | 9 1 | 9·998901 | 42 | 30 |
| 5 | 20 | 8·852525 | 10 298 | 11·147475 | 8·853628 | 10 299 | 11·146372 | 10·001104 | 10 2 | 9·998896 | 40 | 55 |
| 30 | 22 | 8·853408 | 1 29 | 11·146592 | 8·854517 | 1 29 | 11·145483 | 10·001108 | 11 2 | 9·998892 | 38 | 30 |
| 6 | 24 | 8·854291 | 2 58 | 11·145709 | 8·855403 | 2 59 | 11·144597 | 10·001113 | 12 2 | 9·998887 | 36 | 54 |
| 30 | 26 | 8·855171 | 3 88 | 11·144829 | 8·856288 | 3 88 | 11·143712 | 10·001117 | 13 2 | 9·998883 | 34 | 30 |
| 7 | 28 | 8·856049 | 4 117 | 11·143951 | 8·857171 | 4 117 | 11·142829 | 10·001122 | 14 2 | 9·998878 | 32 | 53 |
| 30 | 30 | 8·856926 | 5 146 | 11·143074 | 8·858053 | 5 146 | 11·141947 | 10·001127 | 15 2 | 9·998873 | 30 | 30 |
| 8 | 32 | 8·857801 | 6 175 | 11·142199 | 8·858932 | 6 176 | 11·141068 | 10·001131 | 16 2 | 9·998869 | 28 | 52 |
| 30 | 34 | 8·858674 | 7 204 | 11·141326 | 8·859810 | 7 205 | 11·140190 | 10·001136 | 17 3 | 9·998864 | 26 | 30 |
| 9 | 36 | 8·859546 | 8 233 | 11·140454 | 8·860686 | 8 234 | 11·139314 | 10·001140 | 18 3 | 9·998860 | 24 | 51 |
| 30 | 38 | 8·860415 | 9 263 | 11·139585 | 8·861560 | 9 264 | 11·138440 | 10·001145 | 19 3 | 9·998855 | 22 | 30 |
| 10 | 40 | 8·861283 | 10 292 | 11·138717 | 8·862433 | 10 293 | 11·137567 | 10·001149 | 20 3 | 9·998851 | 20 | 50 |
| 30 | 42 | 8·862149 | 1 29 | 11·137851 | 8·863303 | 1 29 | 11·136697 | 10·001154 | 21 3 | 9·998846 | 18 | 30 |
| 11 | 44 | 8·863014 | 2 57 | 11·136986 | 8·864173 | 2 58 | 11·135827 | 10·001159 | 22 3 | 9·998841 | 16 | 49 |
| 30 | 46 | 8·863877 | 3 86 | 11·136123 | 8·865040 | 3 86 | 11·134960 | 10·001163 | 23 3 | 9·998837 | 14 | 30 |
| 12 | 48 | 8·864738 | 4 114 | 11·135262 | 8·865906 | 4 115 | 11·134094 | 10·001168 | 24 4 | 9·998832 | 12 | 48 |
| 30 | 50 | 8·865597 | 5 143 | 11·134403 | 8·866769 | 5 144 | 11·133231 | 10·001173 | 25 4 | 9·998827 | 10 | 30 |
| 13 | 52 | 8·866455 | 6 172 | 11·133545 | 8·867632 | 6 173 | 11·132368 | 10·001177 | 26 4 | 9·998823 | 8 | 47 |
| 30 | 54 | 8·867310 | 7 200 | 11·132690 | 8·868492 | 7 201 | 11·131508 | 10·001182 | 27 4 | 9·998818 | 6 | 30 |
| 14 | 56 | 8·868165 | 8 229 | 11·131835 | 8·869351 | 8 230 | 11·130649 | 10·001187 | 28 4 | 9·998813 | 4 | 46 |
| 30 | 58 | 8·869017 | 9 257 | 11·130983 | 8·870208 | 9 259 | 11·129792 | 10·001191 | 29 4 | 9·998809 | 2 | 30 |
| 15 | **17** | 8·869868 | 10 286 | 11·130132 | 8·871064 | 10 288 | 11·128936 | 10·001196 | 30 5 | 9·998804 | **43** | 45 |
| 30 | 2 | 8·870717 | 1 28 | 11·129283 | 8·871918 | 1 28 | 11·128082 | 10·001201 | 1 0 | 9·998799 | 58 | 30 |
| 16 | 4 | 8·871565 | 2 56 | 11·128435 | 8·872770 | 2 56 | 11·127230 | 10·001205 | 2 0 | 9·998795 | 56 | 44 |
| 30 | 6 | 8·872410 | 3 84 | 11·127590 | 8·873620 | 3 85 | 11·126380 | 10·001210 | 3 0 | 9·998790 | 54 | 30 |
| 17 | 8 | 8·873255 | 4 112 | 11·126745 | 8·874469 | 4 113 | 11·125531 | 10·001215 | 4 1 | 9·998785 | 52 | 43 |
| 30 | 10 | 8·874097 | 5 140 | 11·125903 | 8·875317 | 5 141 | 11·124683 | 10·001219 | 5 1 | 9·998781 | 50 | 30 |
| 18 | 12 | 8·874938 | 6 168 | 11·125062 | 8·876162 | 6 169 | 11·123838 | 10·001224 | 6 1 | 9·998776 | 48 | 42 |
| 30 | 14 | 8·875777 | 7 196 | 11·124223 | 8·877006 | 7 197 | 11·122994 | 10·001229 | 7 1 | 9·998771 | 46 | 30 |
| 19 | 16 | 8·876615 | 8 224 | 11·123385 | 8·877849 | 8 225 | 11·122151 | 10·001234 | 8 1 | 9·998766 | 44 | 41 |
| 30 | 18 | 8·877451 | 9 252 | 11·122549 | 8·878689 | 9 254 | 11·121311 | 10·001238 | 9 1 | 9·998762 | 42 | 30 |
| 20 | 20 | 8·878285 | 10 280 | 11·121715 | 8·879529 | 10 282 | 11·120471 | 10·001243 | 10 2 | 9·998757 | 40 | 40 |
| 30 | 22 | 8·879118 | 1 27 | 11·120882 | 8·880366 | 1 28 | 11·119634 | 10·001248 | 11 2 | 9·998752 | 38 | 30 |
| 21 | 24 | 8·879949 | 2 55 | 11·120051 | 8·881202 | 2 55 | 11·118798 | 10·001253 | 12 2 | 9·998747 | 36 | 39 |
| 30 | 26 | 8·880779 | 3 82 | 11·119221 | 8·882037 | 3 83 | 11·117963 | 10·001258 | 13 2 | 9·998742 | 34 | 30 |
| 22 | 28 | 8·881607 | 4 110 | 11·118393 | 8·882869 | 4 111 | 11·117131 | 10·001262 | 14 2 | 9·998738 | 32 | 38 |
| 30 | 30 | 8·882433 | 5 137 | 11·117567 | 8·883701 | 5 138 | 11·116299 | 10·001267 | 15 2 | 9·998733 | 30 | 30 |
| 23 | 32 | 8·883258 | 6 165 | 11·116742 | 8·884530 | 6 166 | 11·115470 | 10·001272 | 16 3 | 9·998728 | 28 | 37 |
| 30 | 34 | 8·884081 | 7 192 | 11·115919 | 8·885358 | 7 193 | 11·114642 | 10·001277 | 17 3 | 9·998723 | 26 | 30 |
| 24 | 36 | 8·884903 | 8 220 | 11·115097 | 8·886185 | 8 221 | 11·113815 | 10·001282 | 18 3 | 9·998718 | 24 | 36 |
| 30 | 38 | 8·885723 | 9 247 | 11·114277 | 8·887010 | 9 249 | 11·112990 | 10·001287 | 19 3 | 9·998713 | 22 | 30 |
| 25 | 40 | 8·886542 | 10 275 | 11·113458 | 8·887833 | 10 276 | 11·112167 | 10·001292 | 20 3 | 9·998708 | 20 | 35 |
| 30 | 42 | 8·887359 | 1 27 | 11·112641 | 8·888655 | 1 27 | 11·111345 | 10·001296 | 21 3 | 9·998704 | 18 | 30 |
| 26 | 44 | 8·888174 | 2 54 | 11·111826 | 8·889476 | 2 54 | 11·110524 | 10·001301 | 22 4 | 9·998699 | 16 | 34 |
| 30 | 46 | 8·888988 | 3 81 | 11·111012 | 8·890295 | 3 81 | 11·109705 | 10·001306 | 23 4 | 9·998694 | 14 | 30 |
| 27 | 48 | 8·889801 | 4 108 | 11·110199 | 8·891112 | 4 109 | 11·108888 | 10·001311 | 24 4 | 9·998689 | 12 | 33 |
| 30 | 50 | 8·890612 | 5 135 | 11·109388 | 8·891928 | 5 136 | 11·108072 | 10·001316 | 25 4 | 9·998684 | 10 | 30 |
| 28 | 52 | 8·891421 | 6 162 | 11·108579 | 8·892742 | 6 163 | 11·107258 | 10·001321 | 26 4 | 9·998679 | 8 | 32 |
| 30 | 54 | 8·892229 | 7 189 | 11·107771 | 8·893555 | 7 190 | 11·106445 | 10·001326 | 27 4 | 9·998674 | 6 | 30 |
| 29 | 56 | 8·893035 | 8 216 | 11·106965 | 8·894366 | 8 217 | 11·105634 | 10·001331 | 28 5 | 9·998669 | 4 | 31 |
| 30 | 58 | 8·893840 | 9 243 | 11·106160 | 8·895176 | 9 244 | 11·104824 | 10·001336 | 29 5 | 9·998664 | 2 | 30 |
| 30 | **18** | 8·894643 | 10 270 | 11·105357 | 8·895984 | 10 271 | 11·104016 | 10·001341 | 30 5 | 9·998659 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

85° — 5h 42m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0h 18m — 4°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 8·894643 | | 11·105357 | 8·895984 | | 11·104016 | 10·001341 | | 9·998659 | 42 | 30 |
| 30 | 2 | 8·895445 | 1″ 26 | 11·104555 | 8·896791 | 1″ 27 | 11·103209 | 10·001346 | 1″ 0 | 9·998654 | 58 | 30 |
| 31 | 4 | 8·896246 | 2 53 | 11·103754 | 8·897596 | 2 53 | 11·102404 | 10·001351 | 2 0 | 9·998649 | 56 | 29 |
| 30 | 6 | 8·897044 | 3 79 | 11·102956 | 8·898400 | 3 80 | 11·101600 | 10·001356 | 3 1 | 9·998644 | 54 | 30 |
| 32 | 8 | 8·897842 | 4 106 | 11·102158 | 8·899203 | 4 107 | 11·100797 | 10·001361 | 4 1 | 9·998639 | 52 | 28 |
| 30 | 10 | 8·898638 | 5 132 | 11·101362 | 8·900004 | 5 133 | 11·099996 | 10·001366 | 5 1 | 9·998634 | 50 | 30 |
| 33 | 12 | 8·899432 | 6 159 | 11·100568 | 8·900803 | 6 160 | 11·099197 | 10·001371 | 6 1 | 9·998629 | 48 | 27 |
| 30 | 14 | 8·900225 | 7 185 | 11·099775 | 8·901601 | 7 186 | 11·098399 | 10·001376 | 7 1 | 9·998624 | 46 | 30 |
| 34 | 16 | 8·901017 | 8 212 | 11·098983 | 8·902398 | 8 213 | 11·097602 | 10·001381 | 8 1 | 9·998619 | 44 | 26 |
| 30 | 18 | 8·901807 | 9 238 | 11·098193 | 8·903193 | 9 240 | 11·096807 | 10·001386 | 9 2 | 9·998614 | 42 | 30 |
| 35 | 20 | 8·902596 | 10 265 | 11·097404 | 8·903987 | 10 266 | 11·096013 | 10·001391 | 10 2 | 9·998609 | 40 | 25 |
| 30 | 22 | 8·903383 | 1 26 | 11·096617 | 8·904779 | 1 26 | 11·095221 | 10·001396 | 11 2 | 9·998604 | 38 | 30 |
| 36 | 24 | 8·904169 | 2 52 | 11·095831 | 8·905570 | 2 52 | 11·094430 | 10·001401 | 12 2 | 9·998599 | 36 | 24 |
| 30 | 26 | 8·904953 | 3 78 | 11·095047 | 8·906359 | 3 79 | 11·093641 | 10·001406 | 13 2 | 9·998594 | 34 | 30 |
| 37 | 28 | 8·905736 | 4 104 | 11·094264 | 8·907147 | 4 105 | 11·092853 | 10·001411 | 14 2 | 9·998589 | 32 | 23 |
| 30 | 30 | 8·906517 | 5 130 | 11·093483 | 8·907934 | 5 131 | 11·092066 | 10·001416 | 15 3 | 9·998584 | 30 | 30 |
| 38 | 32 | 8·907297 | 6 156 | 11·092703 | 8·908719 | 6 157 | 11·091281 | 10·001422 | 16 3 | 9·998578 | 28 | 22 |
| 30 | 34 | 8·908076 | 7 182 | 11·091924 | 8·909503 | 7 183 | 11·090497 | 10·001427 | 17 3 | 9·998573 | 26 | 30 |
| 39 | 36 | 8·908853 | 8 208 | 11·091147 | 8·910285 | 8 209 | 11·089715 | 10·001432 | 18 3 | 9·998568 | 24 | 21 |
| 30 | 38 | 8·909629 | 9 234 | 11·090371 | 8·911066 | 9 236 | 11·088934 | 10·001437 | 19 3 | 9·998563 | 22 | 30 |
| 40 | 40 | 8·910404 | 10 260 | 11·089596 | 8·911846 | 10 262 | 11·088154 | 10·001442 | 20 3 | 9·998558 | 20 | 20 |
| 30 | 42 | 8·911177 | 1 26 | 11·088823 | 8·912624 | 1 26 | 11·087376 | 10·001447 | 21 4 | 9·998553 | 18 | 30 |
| 41 | 44 | 8·911949 | 2 51 | 11·088051 | 8·913401 | 2 51 | 11·086599 | 10·001452 | 22 4 | 9·998548 | 16 | 19 |
| 30 | 46 | 8·912719 | 3 77 | 11·087281 | 8·914177 | 3 77 | 11·085823 | 10·001458 | 23 4 | 9·998542 | 14 | 30 |
| 42 | 48 | 8·913488 | 4 102 | 11·086512 | 8·914951 | 4 103 | 11·085049 | 10·001463 | 24 4 | 9·998537 | 12 | 18 |
| 30 | 50 | 8·914256 | 5 128 | 11·085744 | 8·915724 | 5 129 | 11·084276 | 10·001468 | 25 4 | 9·998532 | 10 | 30 |
| 43 | 52 | 8·915022 | 6 153 | 11·084978 | 8·916495 | 6 154 | 11·083505 | 10·001473 | 26 4 | 9·998527 | 8 | 17 |
| 30 | 54 | 8·915787 | 7 179 | 11·084213 | 8·917265 | 7 180 | 11·082735 | 10·001478 | 27 5 | 9·998522 | 6 | 30 |
| 44 | 56 | 8·916550 | 8 204 | 11·083450 | 8·918034 | 8 206 | 11·081966 | 10·001484 | 28 5 | 9·998516 | 4 | 16 |
| 30 | 58 | 8·917313 | 9 230 | 11·082687 | 8·918801 | 9 231 | 11·081199 | 10·001489 | 29 5 | 9·998511 | 2 | 30 |
| 45 | 19 | 8·918073 | 10 255 | 11·081927 | 8·919568 | 10 257 | 11·080432 | 10·001494 | 30 5 | 9·998506 | 42 | 15 |
| 30 | 2 | 8·918833 | 1 25 | 11·081167 | 8·920332 | 1 25 | 11·079668 | 10·001499 | 1 0 | 9·998501 | 58 | 30 |
| 46 | 4 | 8·919591 | 2 50 | 11·080409 | 8·921096 | 2 51 | 11·078904 | 10·001505 | 2 0 | 9·998495 | 56 | 14 |
| 30 | 6 | 8·920348 | 3 75 | 11·079652 | 8·921858 | 3 76 | 11·078142 | 10·001510 | 3 1 | 9·998490 | 54 | 30 |
| 47 | 8 | 8·921103 | 4 100 | 11·078897 | 8·922619 | 4 101 | 11·077381 | 10·001515 | 4 1 | 9·998485 | 52 | 13 |
| 30 | 10 | 8·921858 | 5 125 | 11·078142 | 8·923378 | 5 126 | 11·076622 | 10·001521 | 5 1 | 9·998479 | 50 | 30 |
| 48 | 12 | 8·922610 | 6 150 | 11·077390 | 8·924136 | 6 152 | 11·075864 | 10·001526 | 6 1 | 9·998474 | 48 | 12 |
| 30 | 14 | 8·923362 | 7 175 | 11·076638 | 8·924893 | 7 177 | 11·075107 | 10·001531 | 7 1 | 9·998469 | 46 | 30 |
| 49 | 16 | 8·924112 | 8 201 | 11·075888 | 8·925649 | 8 202 | 11·074351 | 10·001536 | 8 1 | 9·998464 | 44 | 11 |
| 30 | 18 | 8·924861 | 9 226 | 11·075139 | 8·926403 | 9 227 | 11·073597 | 10·001542 | 9 2 | 9·998458 | 42 | 30 |
| 50 | 20 | 8·925609 | 10 251 | 11·074391 | 8·927156 | 10 253 | 11·072844 | 10·001547 | 10 2 | 9·998453 | 40 | 10 |
| 30 | 22 | 8·926355 | 1 25 | 11·073645 | 8·927908 | 1 25 | 11·072092 | 10·001552 | 11 2 | 9·998448 | 38 | 30 |
| 51 | 24 | 8·927100 | 2 49 | 11·072900 | 8·928658 | 2 50 | 11·071342 | 10·001558 | 12 2 | 9·998442 | 36 | 9 |
| 30 | 26 | 8·927844 | 3 74 | 11·072156 | 8·929407 | 3 74 | 11·070593 | 10·001563 | 13 2 | 9·998437 | 34 | 30 |
| 52 | 28 | 8·928587 | 4 99 | 11·071413 | 8·930155 | 4 99 | 11·069845 | 10·001569 | 14 3 | 9·998431 | 32 | 8 |
| 30 | 30 | 8·929328 | 5 123 | 11·070672 | 8·930902 | 5 124 | 11·069098 | 10·001574 | 15 3 | 9·998426 | 30 | 30 |
| 53 | 32 | 8·930068 | 6 148 | 11·069932 | 8·931647 | 6 149 | 11·068353 | 10·001579 | 16 3 | 9·998421 | 28 | 7 |
| 30 | 34 | 8·930806 | 7 173 | 11·069194 | 8·932391 | 7 174 | 11·067609 | 10·001585 | 17 3 | 9·998415 | 26 | 30 |
| 54 | 36 | 8·931544 | 8 197 | 11·068456 | 8·933134 | 8 199 | 11·066866 | 10·001590 | 18 3 | 9·998410 | 24 | 6 |
| 30 | 38 | 8·932280 | 9 222 | 11·067720 | 8·933876 | 9 223 | 11·066124 | 10·001596 | 19 3 | 9·998404 | 22 | 30 |
| 55 | 40 | 8·933015 | 10 247 | 11·066985 | 8·934616 | 10 248 | 11·065384 | 10·001601 | 20 4 | 9·998399 | 20 | 5 |
| 30 | 42 | 8·933749 | 1 24 | 11·066251 | 8·935355 | 1 24 | 11·064645 | 10·001606 | 21 4 | 9·998394 | 18 | 30 |
| 56 | 44 | 8·934481 | 2 48 | 11·065519 | 8·936093 | 2 49 | 11·063907 | 10·001612 | 22 4 | 9·998388 | 16 | 4 |
| 30 | 46 | 8·935212 | 3 73 | 11·064788 | 8·936830 | 3 73 | 11·063170 | 10·001617 | 23 4 | 9·998383 | 14 | 30 |
| 57 | 48 | 8·935942 | 4 97 | 11·064058 | 8·937565 | 4 98 | 11·062435 | 10·001623 | 24 4 | 9·998377 | 12 | 3 |
| 30 | 50 | 8·936671 | 5 121 | 11·063329 | 8·938299 | 5 122 | 11·061701 | 10·001628 | 25 4 | 9·998372 | 10 | 30 |
| 58 | 52 | 8·937398 | 6 145 | 11·062602 | 8·939032 | 6 147 | 11·060968 | 10·001634 | 26 5 | 9·998366 | 8 | 2 |
| 30 | 54 | 8·938125 | 7 170 | 11·061875 | 8·939764 | 7 171 | 11·060236 | 10·001639 | 27 5 | 9·998361 | 6 | 30 |
| 59 | 56 | 8·938850 | 8 194 | 11·061150 | 8·940494 | 8 195 | 11·059506 | 10·001645 | 28 5 | 9·998355 | 4 | 1 |
| 30 | 58 | 8·939573 | 9 218 | 11·060427 | 8·941224 | 9 220 | 11·058776 | 10·001650 | 29 5 | 9·998350 | 2 | 30 |
| 60 | 20 | 8·940296 | 10 242 | 11·059704 | 8·941952 | 10 244 | 11·058048 | 10·001656 | 30 5 | 9·998344 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

85° — 5h 40m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0h 20m — 5°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 8·940296 | | 11·059704 | 8·941952 | | 11·058048 | 10·001656 | | 9·998344 | 40 | 60 |
| 30 | 2 | 8·941017 | 1″ 24 | 11·058983 | 8·942679 | 1″ 24 | 11·057321 | 10·001660 | 1″ 0 | 9·998339 | 58 | 30 |
| 1 | 4 | 8·941738 | 2 48 | 11·058262 | 8·943404 | 2 48 | 11·056596 | 10·001667 | 2 0 | 9·998333 | 56 | 59 |
| 30 | 6 | 8·942457 | 3 71 | 11·057543 | 8·944129 | 3 72 | 11·055871 | 10·001672 | 3 1 | 9·998328 | 54 | 30 |
| 2 | 8 | 8·943174 | 4 95 | 11·056826 | 8·944852 | 4 96 | 11·055148 | 10·001678 | 4 1 | 9·998322 | 52 | 58 |
| 30 | 10 | 8·943891 | 5 119 | 11·056109 | 8·945574 | 5 120 | 11·054426 | 10·001684 | 5 1 | 9·998316 | 50 | 30 |
| 3 | 12 | 8·944606 | 6 143 | 11·055394 | 8·946295 | 6 144 | 11·053705 | 10·001689 | 6 1 | 9·998311 | 48 | 57 |
| 30 | 14 | 8·945321 | 7 167 | 11·054679 | 8·947015 | 7 168 | 11·052985 | 10·001695 | 7 1 | 9·998305 | 46 | 30 |
| 4 | 16 | 8·946034 | 8 191 | 11·053966 | 8·947734 | 8 192 | 11·052266 | 10·001700 | 8 2 | 9·998300 | 44 | 56 |
| 30 | 18 | 8·946745 | 9 214 | 11·053255 | 8·948451 | 9 216 | 11·051549 | 10·001706 | 9 2 | 9·998294 | 42 | 30 |
| 5 | 20 | 8·947456 | 10 238 | 11·052544 | 8·949168 | 10 240 | 11·050832 | 10·001711 | 10 2 | 9·998289 | 40 | 55 |
| 30 | 22 | 8·948166 | 1 23 | 11·051834 | 8·949883 | 1 24 | 11·050117 | 10·001717 | 11 2 | 9·998283 | 38 | 30 |
| 6 | 24 | 8·948874 | 2 47 | 11·051126 | 8·950597 | 2 47 | 11·049403 | 10·001723 | 12 2 | 9·998277 | 36 | 54 |
| 30 | 26 | 8·949581 | 3 70 | 11·050419 | 8·951309 | 3 71 | 11·048691 | 10·001728 | 13 2 | 9·998272 | 34 | 30 |
| 7 | 28 | 8·950287 | 4 94 | 11·049713 | 8·952021 | 4 95 | 11·047979 | 10·001734 | 14 3 | 9·998266 | 32 | 53 |
| 30 | 30 | 8·950992 | 5 117 | 11·049008 | 8·952732 | 5 118 | 11·047268 | 10·001740 | 15 3 | 9·998260 | 30 | 30 |
| 8 | 32 | 8·951696 | 6 141 | 11·048304 | 8·953441 | 6 142 | 11·046559 | 10·001745 | 16 3 | 9·998255 | 28 | 52 |
| 30 | 34 | 8·952398 | 7 164 | 11·047602 | 8·954149 | 7 165 | 11·045851 | 10·001751 | 17 3 | 9·998249 | 26 | 30 |
| 9 | 36 | 8·953100 | 8 188 | 11·046900 | 8·954856 | 8 189 | 11·045144 | 10·001757 | 18 3 | 9·998243 | 24 | 51 |
| 30 | 38 | 8·953800 | 9 211 | 11·046200 | 8·955562 | 9 213 | 11·044438 | 10·001762 | 19 4 | 9·998238 | 22 | 30 |
| 10 | 40 | 8·954499 | 10 235 | 11·045501 | 8·956267 | 10 236 | 11·043733 | 10·001768 | 20 4 | 9·998232 | 20 | 50 |
| 30 | 42 | 8·955197 | 1 23 | 11·044803 | 8·956971 | 1 23 | 11·043029 | 10·001774 | 21 4 | 9·998226 | 18 | 30 |
| 11 | 44 | 8·955894 | 2 46 | 11·044106 | 8·957674 | 2 47 | 11·042326 | 10·001780 | 22 4 | 9·998220 | 16 | 49 |
| 30 | 46 | 8·956590 | 3 69 | 11·043410 | 8·958375 | 3 70 | 11·041625 | 10·001785 | 23 4 | 9·998215 | 14 | 30 |
| 12 | 48 | 8·957284 | 4 92 | 11·042716 | 8·959075 | 4 93 | 11·040925 | 10·001791 | 24 5 | 9·998209 | 12 | 48 |
| 30 | 50 | 8·957978 | 5 115 | 11·042022 | 8·959775 | 5 116 | 11·040225 | 10·001797 | 25 5 | 9·998203 | 10 | 30 |
| 13 | 52 | 8·958670 | 6 138 | 11·041330 | 8·960473 | 6 140 | 11·039527 | 10·001803 | 26 5 | 9·998197 | 8 | 47 |
| 30 | 54 | 8·959362 | 7 161 | 11·040638 | 8·961170 | 7 163 | 11·038830 | 10·001808 | 27 5 | 9·998192 | 6 | 30 |
| 14 | 56 | 8·960052 | 8 185 | 11·039948 | 8·961866 | 8 186 | 11·038134 | 10·001814 | 28 5 | 9·998186 | 4 | 46 |
| 30 | 58 | 8·960741 | 9 208 | 11·039259 | 8·962561 | 9 209 | 11·037439 | 10·001820 | 29 6 | 9·998180 | 2 | 30 |
| 15 | **21** | 8·961429 | 10 231 | 11·038571 | 8·963255 | 10 233 | 11·036745 | 10·001826 | 30 6 | 9·998174 | **39** | 45 |
| 30 | 2 | 8·962116 | 1 23 | 11·037884 | 8·963947 | 1 23 | 11·036053 | 10·001832 | 1 0 | 9·998168 | 58 | 30 |
| 16 | 4 | 8·962801 | 2 45 | 11·037199 | 8·964639 | 2 46 | 11·035361 | 10·001837 | 2 0 | 9·998163 | 56 | 44 |
| 30 | 6 | 8·963486 | 3 68 | 11·036514 | 8·965329 | 3 69 | 11·034671 | 10·001843 | 3 1 | 9·998157 | 54 | 30 |
| 17 | 8 | 8·964170 | 4 91 | 11·035830 | 8·966019 | 4 92 | 11·033981 | 10·001849 | 4 1 | 9·998151 | 52 | 43 |
| 30 | 10 | 8·964852 | 5 114 | 11·035148 | 8·966707 | 5 115 | 11·033293 | 10·001855 | 5 1 | 9·998145 | 50 | 30 |
| 18 | 12 | 8·965534 | 6 136 | 11·034466 | 8·967394 | 6 137 | 11·032606 | 10·001861 | 6 1 | 9·998139 | 48 | 42 |
| 30 | 14 | 8·966214 | 7 159 | 11·033786 | 8·968081 | 7 160 | 11·031919 | 10·001867 | 7 1 | 9·998133 | 46 | 30 |
| 19 | 16 | 8·966893 | 8 182 | 11·033107 | 8·968766 | 8 183 | 11·031234 | 10·001872 | 8 2 | 9·998128 | 44 | 41 |
| 30 | 18 | 8·967572 | 9 205 | 11·032428 | 8·969450 | 9 206 | 11·030550 | 10·001878 | 9 2 | 9·998122 | 42 | 30 |
| 20 | 20 | 8·968249 | 10 227 | 11·031751 | 8·970133 | 10 229 | 11·029867 | 10·001884 | 10 2 | 9·998116 | 40 | 40 |
| 30 | 22 | 8·968925 | 1 22 | 11·031075 | 8·970815 | 1 23 | 11·029185 | 10·001890 | 11 2 | 9·998110 | 38 | 30 |
| 21 | 24 | 8·969600 | 2 45 | 11·030400 | 8·971496 | 2 45 | 11·028504 | 10·001896 | 12 2 | 9·998104 | 36 | 39 |
| 30 | 26 | 8·970274 | 3 67 | 11·029726 | 8·972176 | 3 68 | 11·027824 | 10·001902 | 13 3 | 9·998098 | 34 | 30 |
| 22 | 28 | 8·970947 | 4 89 | 11·029053 | 8·972855 | 4 90 | 11·027145 | 10·001908 | 14 3 | 9·998092 | 32 | 38 |
| 30 | 30 | 8·971619 | 5 112 | 11·028381 | 8·973532 | 5 113 | 11·026468 | 10·001914 | 15 3 | 9·998086 | 30 | 30 |
| 23 | 32 | 8·972289 | 6 134 | 11·027711 | 8·974209 | 6 135 | 11·025791 | 10·001920 | 16 3 | 9·998080 | 28 | 37 |
| 30 | 34 | 8·972959 | 7 156 | 11·027041 | 8·974885 | 7 158 | 11·025115 | 10·001926 | 17 3 | 9·998074 | 26 | 30 |
| 24 | 36 | 8·973628 | 8 179 | 11·026372 | 8·975560 | 8 180 | 11·024440 | 10·001932 | 18 4 | 9·998068 | 24 | 36 |
| 30 | 38 | 8·974296 | 9 201 | 11·025704 | 8·976233 | 9 203 | 11·023767 | 10·001938 | 19 4 | 9·998062 | 22 | 30 |
| 25 | 40 | 8·974962 | 10 223 | 11·025038 | 8·976906 | 10 226 | 11·023094 | 10·001944 | 20 4 | 9·998056 | 20 | 35 |
| 30 | 42 | 8·975628 | 1 22 | 11·024372 | 8·977578 | 1 22 | 11·022422 | 10·001950 | 21 4 | 9·998050 | 18 | 30 |
| 26 | 44 | 8·976293 | 2 44 | 11·023707 | 8·978248 | 2 44 | 11·021752 | 10·001956 | 22 5 | 9·998044 | 16 | 34 |
| 30 | 46 | 8·976956 | 3 66 | 11·023044 | 8·978918 | 3 67 | 11·021082 | 10·001962 | 23 5 | 9·998038 | 14 | 30 |
| 27 | 48 | 8·977619 | 4 88 | 11·022381 | 8·979586 | 4 89 | 11·020414 | 10·001968 | 24 5 | 9·998032 | 12 | 33 |
| 30 | 50 | 8·978280 | 5 110 | 11·021720 | 8·980254 | 5 111 | 11·019746 | 10·001974 | 25 5 | 9·998026 | 10 | 30 |
| 28 | 52 | 8·978941 | 6 132 | 11·021059 | 8·980921 | 6 133 | 11·019079 | 10·001980 | 26 5 | 9·998020 | 8 | 32 |
| 30 | 54 | 8·979600 | 7 154 | 11·020400 | 8·981586 | 7 156 | 11·018414 | 10·001986 | 27 5 | 9·998014 | 6 | 30 |
| 29 | 56 | 8·980259 | 8 176 | 11·019741 | 8·982251 | 8 178 | 11·017749 | 10·001992 | 28 6 | 9·998008 | 4 | 31 |
| 30 | 58 | 8·980916 | 9 198 | 11·019084 | 8·982914 | 9 200 | 11·017086 | 10·001998 | 29 6 | 9·998002 | 2 | 30 |
| 30 | **22** | 8·981573 | 10 220 | 11·018427 | 8·983577 | 10 222 | 11·016423 | 10·002004 | 30 6 | 9·997996 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

84° — 5h 38m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

0h 22m — 5°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 8·981573 | | 11·018427 | 8·983577 | | 11·016423 | 10·002004 | | 9·997996 | 38 | 30 |
| 30 | 2 | 8·982228 | 1″ 22 | 11·017772 | 8·984238 | 1″ 22 | 11·015762 | 10·002010 | 1″ 0 | 9·997990 | 58 | 30 |
| 31 | 4 | 8·982883 | 2 43 | 11·017117 | 8·984899 | 2 44 | 11·015101 | 10·002016 | 2 0 | 9·997984 | 56 | 29 |
| 30 | 6 | 8·983536 | 3 65 | 11·016464 | 8·985559 | 3 66 | 11·014441 | 10·002022 | 3 1 | 9·997978 | 54 | 30 |
| 32 | 8 | 8·984189 | 4 87 | 11·015811 | 8·986217 | 4 88 | 11·013783 | 10·002028 | 4 1 | 9·997972 | 52 | 28 |
| 30 | 10 | 8·984840 | 5 109 | 11·015160 | 8·986875 | 5 110 | 11·013125 | 10·002035 | 5 1 | 9·997965 | 50 | 30 |
| 33 | 12 | 8·985491 | 6 130 | 11·014509 | 8·987532 | 6 131 | 11·012468 | 10·002041 | 6 1 | 9·997959 | 48 | 27 |
| 30 | 14 | 8·986141 | 7 152 | 11·013859 | 8·988187 | 7 153 | 11·011813 | 10·002047 | 7 1 | 9·997953 | 46 | 30 |
| 34 | 16 | 8·986789 | 8 174 | 11·013211 | 8·988842 | 8 175 | 11·011158 | 10·002053 | 8 2 | 9·997947 | 44 | 26 |
| 30 | 18 | 8·987437 | 9 195 | 11·012563 | 8·989496 | 9 197 | 11·010504 | 10·002059 | 9 2 | 9·997941 | 42 | 30 |
| 35 | 20 | 8·988083 | 10 217 | 11·011917 | 8·990149 | 10 219 | 11·009851 | 10·002065 | 10 2 | 9·997935 | 40 | 25 |
| 30 | 22 | 8·988729 | 1 21 | 11·011271 | 8·990801 | 1 22 | 11·009199 | 10·002071 | 11 2 | 9·997929 | 38 | 30 |
| 36 | 24 | 8·989374 | 2 43 | 11·010626 | 8·991451 | 2 43 | 11·008549 | 10·002078 | 12 2 | 9·997922 | 36 | 24 |
| 30 | 26 | 8·990017 | 3 64 | 11·009983 | 8·992101 | 3 65 | 11·007899 | 10·002084 | 13 3 | 9·997916 | 34 | 30 |
| 37 | 28 | 8·990660 | 4 85 | 11·009340 | 8·992750 | 4 86 | 11·007250 | 10·002090 | 14 3 | 9·997910 | 32 | 23 |
| 30 | 30 | 8·991302 | 5 107 | 11·008698 | 8·993398 | 5 108 | 11·006602 | 10·002096 | 15 3 | 9·997904 | 30 | 30 |
| 38 | 32 | 8·991943 | 6 128 | 11·008057 | 8·994045 | 6 129 | 11·005955 | 10·002103 | 16 3 | 9·997897 | 28 | 22 |
| 30 | 34 | 8·992583 | 7 150 | 11·007417 | 8·994692 | 7 151 | 11·005308 | 10·002109 | 17 4 | 9·997891 | 26 | 30 |
| 39 | 36 | 8·993222 | 8 171 | 11·006778 | 8·995337 | 8 173 | 11·004663 | 10·002115 | 18 4 | 9·997885 | 24 | 21 |
| 30 | 38 | 8·993860 | 9 192 | 11·006140 | 8·995981 | 9 194 | 11·004019 | 10·002121 | 19 4 | 9·997879 | 22 | 30 |
| 40 | 40 | 8·994497 | 10 214 | 11·005503 | 8·996624 | 10 216 | 11·003376 | 10·002128 | 20 4 | 9·997872 | 20 | 20 |
| 30 | 42 | 8·995133 | 1 21 | 11·004867 | 8·997267 | 1 21 | 11·002733 | 10·002134 | 21 4 | 9·997866 | 18 | 30 |
| 41 | 44 | 8·995768 | 2 42 | 11·004232 | 8·997908 | 2 43 | 11·002092 | 10·002140 | 22 5 | 9·997860 | 16 | 19 |
| 30 | 46 | 8·996402 | 3 63 | 11·003598 | 8·998549 | 3 64 | 11·001451 | 10·002146 | 23 5 | 9·997854 | 14 | 30 |
| 42 | 48 | 8·997036 | 4 84 | 11·002964 | 8·999188 | 4 85 | 11·000812 | 10·002153 | 24 5 | 9·997847 | 12 | 18 |
| 30 | 50 | 8·997668 | 5 105 | 11·002332 | 8·999827 | 5 106 | 11·000173 | 10·002159 | 25 5 | 9·997841 | 10 | 30 |
| 43 | 52 | 8·998299 | 6 126 | 11·001701 | 9·000465 | 6 128 | 10·999535 | 10·002165 | 26 5 | 9·997835 | 8 | 17 |
| 30 | 54 | 8·998930 | 7 147 | 11·001070 | 9·001102 | 7 149 | 10·998898 | 10·002172 | 27 6 | 9·997828 | 6 | 30 |
| 44 | 56 | 8·999560 | 8 168 | 11·000440 | 9·001738 | 8 170 | 10·998262 | 10·002178 | 28 6 | 9·997822 | 4 | 16 |
| 30 | 58 | 9·000188 | 9 189 | 10·999812 | 9·002373 | 9 191 | 10·997627 | 10·002184 | 29 6 | 9·997816 | 2 | 30 |
| 45 | 23 | 9·000816 | 10 210 | 10·999184 | 9·003007 | 10 213 | 10·996993 | 10·002191 | 30 6 | 9·997809 | 37 | 15 |
| 30 | 2 | 9·001443 | 1 21 | 10·998557 | 9·003640 | 1 21 | 10·996360 | 10·002197 | 1 0 | 9·997803 | 58 | 30 |
| 46 | 4 | 9·002069 | 2 41 | 10·997931 | 9·004272 | 2 42 | 10·995728 | 10·002203 | 2 0 | 9·997797 | 56 | 14 |
| 30 | 6 | 9·002694 | 3 62 | 10·997306 | 9·004904 | 3 63 | 10·995096 | 10·002210 | 3 1 | 9·997790 | 54 | 30 |
| 47 | 8 | 9·003318 | 4 83 | 10·996682 | 9·005534 | 4 84 | 10·994466 | 10·002216 | 4 1 | 9·997784 | 52 | 13 |
| 30 | 10 | 9·003941 | 5 104 | 10·996059 | 9·006164 | 5 105 | 10·993836 | 10·002223 | 5 1 | 9·997777 | 50 | 30 |
| 48 | 12 | 9·004563 | 6 124 | 10·995437 | 9·006792 | 6 126 | 10·993208 | 10·002229 | 6 1 | 9·997771 | 48 | 2 |
| 30 | 14 | 9·005185 | 7 145 | 10·994815 | 9·007420 | 7 147 | 10·992580 | 10·002235 | 7 1 | 9·997765 | 46 | 30 |
| 49 | 16 | 9·005805 | 8 166 | 10·994195 | 9·008047 | 8 167 | 10·991953 | 10·002242 | 8 2 | 9·997758 | 44 | 11 |
| 30 | 18 | 9·006425 | 9 187 | 10·993575 | 9·008673 | 9 188 | 10·991327 | 10·002248 | 9 2 | 9·997752 | 42 | 30 |
| 50 | 20 | 9·007044 | 10 207 | 10·992956 | 9·009298 | 10 209 | 10·990702 | 10·002255 | 10 2 | 9·997745 | 40 | 10 |
| 30 | 22 | 9·007661 | 1 20 | 10·992339 | 9·009923 | 1 21 | 10·990077 | 10·002261 | 11 2 | 9·997739 | 38 | 30 |
| 51 | 24 | 9·008278 | 2 41 | 10·991722 | 9·010546 | 2 41 | 10·989454 | 10·002268 | 12 3 | 9·997732 | 36 | 9 |
| 30 | 26 | 9·008894 | 3 61 | 10·991106 | 9·011169 | 3 62 | 10·988831 | 10·002274 | 13 3 | 9·997726 | 34 | 30 |
| 52 | 28 | 9·009510 | 4 82 | 10·990490 | 9·011790 | 4 83 | 10·988210 | 10·002281 | 14 3 | 9·997719 | 32 | 8 |
| 30 | 30 | 9·010124 | 5 102 | 10·989876 | 9·012411 | 5 103 | 10·987589 | 10·002287 | 15 3 | 9·997713 | 30 | 30 |
| 53 | 32 | 9·010737 | 6 123 | 10·989263 | 9·013031 | 6 124 | 10·986969 | 10·002294 | 16 3 | 9·997706 | 28 | 7 |
| 30 | 34 | 9·011350 | 7 143 | 10·988650 | 9·013650 | 7 145 | 10·986350 | 10·002300 | 17 4 | 9·997700 | 26 | 30 |
| 54 | 36 | 9·011962 | 8 163 | 10·988038 | 9·014268 | 8 165 | 10·985732 | 10·002307 | 18 4 | 9·997693 | 24 | 6 |
| 30 | 38 | 9·012572 | 9 184 | 10·987428 | 9·014886 | 9 186 | 10·985114 | 10·002313 | 19 4 | 9·997687 | 22 | 30 |
| 55 | 40 | 9·013182 | 10 204 | 10·986818 | 9·015502 | 10 207 | 10·984498 | 10·002320 | 20 4 | 0·997680 | 20 | 5 |
| 30 | 42 | 9·013791 | 1 20 | 10·986209 | 9·016118 | 1 20 | 10·983882 | 10·002326 | 21 4 | 9·997674 | 18 | 30 |
| 56 | 44 | 9·014400 | 2 40 | 10·985600 | 9·016732 | 2 41 | 10·983268 | 10·002333 | 22 5 | 9·997667 | 16 | 4 |
| 30 | 46 | 9·015007 | 3 61 | 10·984993 | 9·017346 | 3 61 | 10·982654 | 10·002339 | 23 5 | 9·997661 | 14 | 30 |
| 57 | 48 | 9·015613 | 4 81 | 10·984387 | 9·017959 | 4 81 | 10·982041 | 10·002346 | 24 5 | 9·997654 | 12 | 3 |
| 30 | 50 | 9·016219 | 5 101 | 10·983781 | 9·018572 | 5 102 | 10·981428 | 10·002353 | 25 5 | 9·997647 | 16 | 30 |
| 58 | 52 | 9·016824 | 6 121 | 10·983176 | 9·019183 | 6 122 | 10·980817 | 10·002359 | 26 5 | 9·997641 | 8 | 2 |
| 30 | 54 | 9·017428 | 7 141 | 10·982572 | 9·019794 | 7 143 | 10·980206 | 10·002366 | 27 6 | 9·997634 | 6 | 30 |
| 59 | 56 | 9·018031 | 8 161 | 10·981969 | 9·020403 | 8 163 | 10·979597 | 10·002372 | 28 6 | 9·997628 | 4 | 1 |
| 30 | 58 | 9·018633 | 9 182 | 10·981367 | 9·021012 | 9 183 | 10·978988 | 10·002379 | 29 6 | 9·997621 | 2 | 30 |
| 60 | 24 | 9·019235 | 10 202 | 10·980765 | 9·021620 | 10 204 | 10·978380 | 10·002386 | 30 6 | 9·997614 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

84° — 5h 36m

## TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

0h 24m — 6°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·019235 | | 10·980765 | 9·021620 | | 10·978380 | 10·002386 | | 9·997614 | 36 | 60 |
| 30 | 2 | 9·019835 | 1″ 20 | 10·980165 | 9·022227 | 1″ 20 | 10·977773 | 10·002392 | 1 0 | 9·997608 | 58 | 30 |
| 1 | 4 | 9·020435 | 2 40 | 10·979565 | 9·022834 | 2 40 | 10·977166 | 10·002399 | 2 0 | 9·997601 | 56 | 59 |
| 30 | 6 | 9·021034 | 3 60 | 10·978966 | 9·023439 | 3 60 | 10·976561 | 10·002406 | 3 1 | 9·997594 | 54 | 30 |
| 2 | 8 | 9·021632 | 4 79 | 10·978368 | 9·024044 | 4 80 | 10·975956 | 10·002412 | 4 1 | 9·997588 | 52 | 58 |
| 30 | 10 | 9·022229 | 5 99 | 10·977771 | 9·024648 | 5 101 | 10·975352 | 10·002419 | 5 1 | 9·997581 | 50 | 30 |
| 3 | 12 | 9·022825 | 6 119 | 10·977175 | 9·025251 | 6 121 | 10·974749 | 10·002426 | 6 1 | 9·997574 | 48 | 57 |
| 30 | 14 | 9·023421 | 7 139 | 10·976579 | 9·025853 | 7 141 | 10·974147 | 10·002432 | 7 2 | 9·997568 | 46 | 30 |
| 4 | 16 | 9·024016 | 8 159 | 10·975984 | 9·026455 | 8 161 | 10·973545 | 10·002439 | 8 2 | 9·997561 | 44 | 56 |
| 30 | 18 | 9·024610 | 9 179 | 10·975390 | 9·027055 | 9 181 | 10·972945 | 10·002446 | 9 2 | 9·997554 | 42 | 30 |
| 5 | 20 | 9·025203 | 10 199 | 10·974797 | 9·027655 | 10 201 | 10·972345 | 10·002453 | 10 2 | 9·997547 | 40 | 55 |
| 30 | 22 | 9·025795 | 1 20 | 10·974205 | 9·028254 | 1 20 | 10·971746 | 10·002459 | 11 2 | 9·997541 | 38 | 30 |
| 6 | 24 | 9·026386 | 2 39 | 10·973614 | 9·028852 | 2 40 | 10·971148 | 10·002466 | 12 3 | 9·997534 | 36 | 54 |
| 30 | 26 | 9·026977 | 3 59 | 10·973023 | 9·029450 | 3 59 | 10·970550 | 10·002473 | 13 3 | 9·997527 | 34 | 30 |
| 7 | 28 | 9·027567 | 4 78 | 10·972433 | 9·030046 | 4 79 | 10·969954 | 10·002480 | 14 3 | 9·997520 | 32 | 53 |
| 30 | 30 | 9·028156 | 5 98 | 10·971844 | 9·030642 | 5 99 | 10·969358 | 10·002486 | 15 3 | 9·997514 | 30 | 30 |
| 8 | 32 | 9·028744 | 6 118 | 10·971256 | 9·031237 | 6 119 | 10·968763 | 10·002493 | 16 4 | 9·997507 | 28 | 52 |
| 30 | 34 | 9·029332 | 7 137 | 10·970668 | 9·031831 | 7 139 | 10·968169 | 10·002500 | 17 4 | 9·997500 | 26 | 30 |
| 9 | 36 | 9·029918 | 8 157 | 10·970082 | 9·032425 | 8 159 | 10·967575 | 10·002507 | 18 4 | 9·997493 | 24 | 51 |
| 30 | 38 | 9·030504 | 9 176 | 10·969496 | 9·033017 | 9 178 | 10·966983 | 10·002513 | 19 4 | 9·997487 | 22 | 30 |
| 10 | 40 | 9·031089 | 10 196 | 10·968911 | 9·033609 | 10 198 | 10·966391 | 10·002520 | 20 5 | 9·997480 | 20 | 50 |
| 30 | 42 | 9·031673 | 1 19 | 10·968327 | 9·034200 | 1 20 | 10·965800 | 10·002527 | 21 5 | 9·997473 | 18 | 30 |
| 11 | 44 | 9·032257 | 2 39 | 10·967743 | 9·034791 | 2 39 | 10·965209 | 10·002534 | 22 5 | 9·997466 | 16 | 49 |
| 30 | 46 | 9·032839 | 3 58 | 10·967161 | 9·035380 | 3 59 | 10·964620 | 10·002541 | 23 5 | 9·997459 | 14 | 30 |
| 12 | 48 | 9·033421 | 4 77 | 10·966579 | 9·035969 | 4 78 | 10·964031 | 10·002548 | 24 5 | 9·997452 | 12 | 48 |
| 30 | 50 | 9·034002 | 5 97 | 10·965998 | 9·036557 | 5 98 | 10·963443 | 10·002555 | 25 6 | 9·997445 | 10 | 30 |
| 13 | 52 | 9·034582 | 6 116 | 10·965418 | 9·037144 | 6 117 | 10·962856 | 10·002561 | 26 6 | 9·997439 | 8 | 47 |
| 30 | 54 | 9·035162 | 7 135 | 10·964838 | 9·037730 | 7 137 | 10·962270 | 10·002568 | 27 6 | 9·997432 | 6 | 30 |
| 14 | 56 | 9·035741 | 8 155 | 10·964259 | 9·038316 | 8 157 | 10·961684 | 10·002575 | 28 6 | 9·997425 | 4 | 46 |
| 30 | 58 | 9·036319 | 9 174 | 10·963681 | 9·038901 | 9 176 | 10·961099 | 10·002582 | 29 7 | 9·997418 | 2 | 30 |
| 15 | 25 | 9·036896 | 10 193 | 10·963104 | 9·039485 | 10 196 | 10·960515 | 10·002589 | 30 7 | 9·997411 | 35 | 45 |
| 30 | 2 | 9·037472 | 1 19 | 10·962528 | 9·040068 | 1 19 | 10·959932 | 10·002596 | 1 0 | 9·997404 | 58 | 30 |
| 16 | 4 | 9·038048 | 2 38 | 10·961952 | 9·040651 | 2 39 | 10·959349 | 10·002603 | 2 0 | 9·997397 | 56 | 44 |
| 30 | 6 | 9·038623 | 3 57 | 10·961377 | 9·041232 | 3 58 | 10·958768 | 10·002610 | 3 1 | 9·997390 | 54 | 30 |
| 17 | 8 | 9·039197 | 4 76 | 10·960803 | 9·041813 | 4 77 | 10·958187 | 10·002617 | 4 1 | 9·997383 | 52 | 43 |
| 30 | 10 | 9·039770 | 5 95 | 10·960230 | 9·042394 | 5 97 | 10·957606 | 10·002624 | 5 1 | 9·997376 | 50 | 30 |
| 18 | 12 | 9·040342 | 6 114 | 10·959658 | 9·042973 | 6 116 | 10·957027 | 10·002631 | 6 1 | 9·997369 | 48 | 42 |
| 30 | 14 | 9·040914 | 7 133 | 10·959086 | 9·043552 | 7 135 | 10·956448 | 10·002638 | 7 2 | 9·997362 | 46 | 30 |
| 19 | 16 | 9·041485 | 8 153 | 10·958515 | 9·044130 | 8 154 | 10·955870 | 10·002645 | 8 2 | 9·997355 | 44 | 41 |
| 30 | 18 | 9·042055 | 9 172 | 10·957945 | 9·044707 | 9 174 | 10·955293 | 10·002652 | 9 2 | 9·997348 | 42 | 30 |
| 20 | 20 | 9·042625 | 10 191 | 10·957375 | 9·045284 | 10 193 | 10·954716 | 10·002659 | 10 2 | 9·997341 | 40 | 40 |
| 30 | 22 | 9·043194 | 1 19 | 10·956806 | 9·045859 | 1 19 | 10·954141 | 10·002666 | 11 3 | 9·997334 | 38 | 30 |
| 21 | 24 | 9·043762 | 2 38 | 10·956238 | 9·046434 | 2 38 | 10·953566 | 10·002673 | 12 3 | 9·997327 | 36 | 39 |
| 30 | 26 | 9·044329 | 3 56 | 10·955671 | 9·047009 | 3 57 | 10·952991 | 10·002680 | 13 3 | 9·997320 | 34 | 30 |
| 22 | 28 | 9·044895 | 4 75 | 10·955105 | 9·047582 | 4 76 | 10·952418 | 10·002687 | 14 3 | 9·997313 | 32 | 38 |
| 30 | 30 | 9·045461 | 5 94 | 10·954539 | 9·048155 | 5 95 | 10·951845 | 10·002694 | 15 4 | 9·997306 | 30 | 30 |
| 23 | 32 | 9·046026 | 6 113 | 10·953974 | 9·048727 | 6 114 | 10·951273 | 10·002701 | 16 4 | 9·997299 | 28 | 37 |
| 30 | 34 | 9·046590 | 7 132 | 10·953410 | 9·049298 | 7 133 | 10·950702 | 10·002708 | 17 4 | 9·997292 | 26 | 30 |
| 24 | 36 | 9·047154 | 8 151 | 10·952846 | 9·049869 | 8 153 | 10·950131 | 10·002715 | 18 4 | 9·997285 | 24 | 36 |
| 30 | 38 | 9·047717 | 9 169 | 10·952283 | 9·050439 | 9 172 | 10·949561 | 10·002722 | 19 4 | 9·997278 | 22 | 30 |
| 25 | 40 | 9·048279 | 10 188 | 10·951721 | 9·051008 | 10 191 | 10·948992 | 10·002729 | 20 5 | 9·997271 | 20 | 35 |
| 30 | 42 | 9·048840 | 1 19 | 10·951160 | 9·051576 | 1 19 | 10·948424 | 10·002736 | 21 5 | 9·997264 | 18 | 30 |
| 26 | 44 | 9·049400 | 2 37 | 10·950600 | 9·052144 | 2 38 | 10·947856 | 10·002743 | 22 5 | 9·997257 | 16 | 34 |
| 30 | 46 | 9·049960 | 3 56 | 10·950040 | 9·052711 | 3 56 | 10·947289 | 10·002751 | 23 5 | 9·997249 | 14 | 30 |
| 27 | 48 | 9·050519 | 4 74 | 10·949481 | 9·053277 | 4 75 | 10·946723 | 10·002758 | 24 6 | 9·997242 | 12 | 33 |
| 30 | 50 | 9·051078 | 5 93 | 10·948922 | 9·053843 | 5 94 | 10·946157 | 10·002765 | 25 5 | 9·997235 | 10 | 30 |
| 28 | 52 | 9·051635 | 6 111 | 10·948365 | 9·054407 | 6 113 | 10·945593 | 10·002772 | 26 6 | 9·997228 | 8 | 32 |
| 30 | 54 | 9·052192 | 7 130 | 10·947808 | 9·054972 | 7 132 | 10·945028 | 10·002779 | 27 7 | 9·997221 | 6 | 30 |
| 29 | 56 | 9·052749 | 8 149 | 10·947251 | 9·055535 | 8 150 | 10·944465 | 10·002786 | 28 7 | 9·997214 | 4 | 31 |
| 30 | 58 | 9·053304 | 9 167 | 10·946696 | 9·056098 | 9 169 | 10·943902 | 10·002794 | 29 7 | 9·997206 | 2 | 30 |
| 30 | 26 | 9·053859 | 10 186 | 10·946141 | 9·056659 | 10 188 | 10·943341 | 10·002801 | 30 7 | 9·997199 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

83° — 5h 34m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0h 26m — 6° 

| ′ ″ | m s | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m s | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·053859 | | 10·946141 | 9·056659 | | 10·943341 | 10·002801 | | 9·997199 | 34 | 30 |
| 30 | 2 | 9·054413 | 1″ 18 | 10·945587 | 9·057221 | 1″ 19 | 10·942779 | 10·002808 | 1″ 0 | 9·997192 | 58 | 30 |
| 31 | 4 | 9·054966 | 2 37 | 10·945034 | 9·057781 | 2 37 | 10·942219 | 10·002815 | 2 0 | 9·997185 | 56 | 29 |
| 30 | 6 | 9·055519 | 3 55 | 10·944481 | 9·058341 | 3 56 | 10·941659 | 10·002822 | 3 1 | 9·997178 | 54 | 30 |
| 32 | 8 | 9·056071 | 4 73 | 10·943929 | 9·058900 | 4 74 | 10·941100 | 10·002830 | 4 1 | 9·997170 | 52 | 28 |
| 30 | 10 | 9·056622 | 5 92 | 10·943378 | 9·059459 | 5 93 | 10·940541 | 10·002837 | 5 1 | 9·997163 | 50 | 30 |
| 33 | 12 | 9·057172 | 6 110 | 10·942828 | 9·060016 | 6 111 | 10·939984 | 10·002844 | 6 1 | 9·997156 | 48 | 27 |
| 30 | 14 | 9·057722 | 7 128 | 10·942278 | 9·060573 | 7 130 | 10·939427 | 10·002851 | 7 2 | 9·997149 | 46 | 30 |
| 34 | 16 | 9·058271 | 8 147 | 10·941729 | 9·061130 | 8 149 | 10·938870 | 10·002859 | 8 2 | 9·997141 | 44 | 26 |
| 30 | 18 | 9·058820 | 9 165 | 10·941180 | 9·061685 | 9 167 | 10·938315 | 10·002866 | 9 2 | 9·997134 | 42 | 30 |
| 35 | 20 | 9·059367 | 10 183 | 10·940633 | 9·062240 | 10 186 | 10·937760 | 10·002873 | 10 2 | 9·997127 | 40 | 25 |
| 30 | 22 | 9·059914 | 1 18 | 10·940086 | 9·062795 | 1 18 | 10·937205 | 10·002880 | 11 3 | 9·997120 | 38 | 30 |
| 36 | 24 | 9·060460 | 2 36 | 10·939540 | 9·063348 | 2 37 | 10·936652 | 10·002888 | 12 3 | 9·997112 | 36 | 24 |
| 30 | 26 | 9·061006 | 3 54 | 10·938994 | 9·063901 | 3 55 | 10·936099 | 10·002895 | 13 3 | 9·997105 | 34 | 30 |
| 37 | 28 | 9·061551 | 4 73 | 10·938449 | 9·064453 | 4 73 | 10·935547 | 10·002902 | 14 4 | 9·997098 | 32 | 23 |
| 30 | 30 | 9·062095 | 5 91 | 10·937905 | 9·065005 | 5 92 | 10·934995 | 10·002910 | 15 4 | 9·997090 | 30 | 30 |
| 38 | 32 | 9·062639 | 6 109 | 10·937361 | 9·065556 | 6 110 | 10·934444 | 10·002917 | 16 4 | 9·997083 | 28 | 22 |
| 30 | 34 | 9·063181 | 7 127 | 10·936819 | 9·066106 | 7 129 | 10·933894 | 10·002924 | 17 4 | 9·997076 | 26 | 30 |
| 39 | 36 | 9·063724 | 8 145 | 10·936276 | 9·066655 | 8 147 | 10·933345 | 10·002932 | 18 4 | 9·997068 | 24 | 21 |
| 30 | 38 | 9·064265 | 9 163 | 10·935735 | 9·067204 | 9 165 | 10·932796 | 10·002939 | 19 4 | 9·997061 | 22 | 30 |
| 40 | 40 | 9·064806 | 10 181 | 10·935194 | 9·067752 | 10 184 | 10·932248 | 10·002947 | 20 5 | 9·997053 | 20 | 20 |
| 30 | 42 | 9·065346 | 1 18 | 10·934654 | 9·068300 | 1 18 | 10·931700 | 10·002954 | 21 5 | 9·997046 | 18 | 30 |
| 41 | 44 | 9·065885 | 2 36 | 10·934115 | 9·068846 | 2 36 | 10·931154 | 10·002951 | 22 5 | 9·997039 | 16 | 19 |
| 30 | 46 | 9·066424 | 3 54 | 10·933576 | 9·069393 | 3 54 | 10·930607 | 10·002969 | 23 6 | 9·997031 | 14 | 30 |
| 42 | 48 | 9·066962 | 4 72 | 10·933038 | 9·069938 | 4 73 | 10·930062 | 10·002976 | 24 6 | 9·997024 | 12 | 18 |
| 30 | 50 | 9·067499 | 5 90 | 10·932501 | 9·070483 | 5 91 | 10·929517 | 10·002984 | 25 6 | 9·997016 | 10 | 30 |
| 43 | 52 | 9·068036 | 6 107 | 10·931964 | 9·071027 | 6 109 | 10·928973 | 10·002991 | 26 7 | 9·997009 | 8 | 17 |
| 30 | 54 | 9·068572 | 7 125 | 10·931428 | 9·071570 | 7 127 | 10·928430 | 10·002998 | 27 7 | 9·997002 | 6 | 30 |
| 44 | 56 | 9·069107 | 8 143 | 10·930893 | 9·072113 | 8 145 | 10·927887 | 10·003006 | 28 7 | 9·996994 | 4 | 16 |
| 30 | 58 | 9·069642 | 9 161 | 10·930358 | 9·072655 | 9 163 | 10·927345 | 10·003013 | 29 7 | 9·996987 | 2 | 30 |
| 45 | 27 | 9·070176 | 10 179 | 10·929824 | 9·073197 | 10 181 | 10·926803 | 10·003021 | 30 7 | 9·996979 | 33 | 15 |
| 30 | 2 | 9·070709 | 1 18 | 10·929291 | 9·073738 | 1 18 | 10·926262 | 10·003028 | 1 0 | 9·996972 | 58 | 30 |
| 46 | 4 | 9·071242 | 2 35 | 10·928758 | 9·074278 | 2 36 | 10·925722 | 10·003036 | 2 1 | 9·996964 | 56 | 14 |
| 30 | 6 | 9·071774 | 3 53 | 10·928226 | 9·074817 | 3 54 | 10·925183 | 10·003043 | 3 1 | 9·996957 | 54 | 30 |
| 47 | 8 | 9·072306 | 4 71 | 10·927694 | 9·075356 | 4 72 | 10·924644 | 10·003051 | 4 1 | 9·996949 | 52 | 13 |
| 30 | 10 | 9·072836 | 5 88 | 10·927164 | 9·075895 | 5 90 | 10·924105 | 10·003058 | 5 1 | 9·996942 | 50 | 30 |
| 48 | 12 | 9·073366 | 6 106 | 10·926634 | 9·076432 | 6 107 | 10·923568 | 10·003066 | 6 2 | 9·996934 | 48 | 12 |
| 30 | 14 | 9·073896 | 7 124 | 10·926104 | 9·076969 | 7 125 | 10·923031 | 10·003073 | 7 2 | 9·996927 | 46 | 30 |
| 49 | 16 | 9·074424 | 8 141 | 10·925576 | 9·077505 | 8 143 | 10·922495 | 10·003081 | 8 2 | 9·996919 | 44 | 11 |
| 30 | 18 | 9·074952 | 9 159 | 10·925047 | 9·078041 | 9 161 | 10·921959 | 10·003089 | 9 2 | 9·996911 | 42 | 30 |
| 50 | 20 | 9·075480 | 10 177 | 10·924520 | 9·078576 | 10 179 | 10·921424 | 10·003096 | 10 3 | 9·996904 | 40 | 10 |
| 30 | 22 | 9·076007 | 1 17 | 10·923993 | 9·079110 | 1 18 | 10·920890 | 10·003104 | 11 3 | 9·996896 | 38 | 30 |
| 51 | 24 | 9·076533 | 2 35 | 10·923467 | 9·079644 | 2 35 | 10·920356 | 10·003111 | 12 3 | 9·996889 | 36 | 9 |
| 30 | 26 | 9·077058 | 3 52 | 10·922942 | 9·080177 | 3 53 | 10·919823 | 10·003119 | 13 3 | 9·996881 | 34 | 30 |
| 52 | 28 | 9·077583 | 4 70 | 10·922417 | 9·080710 | 4 71 | 10·919290 | 10·003126 | 14 4 | 9·996874 | 32 | 8 |
| 30 | 30 | 9·078107 | 5 87 | 10·921893 | 9·081241 | 5 89 | 10·918759 | 10·003134 | 15 4 | 9·996866 | 30 | 30 |
| 53 | 32 | 9·078631 | 6 105 | 10·921369 | 9·081773 | 6 106 | 10·918227 | 10·003142 | 16 4 | 9·996858 | 28 | 7 |
| 30 | 34 | 9·079154 | 7 122 | 10·920846 | 9·082303 | 7 124 | 10·917697 | 10·003149 | 17 4 | 9·996851 | 26 | 30 |
| 54 | 36 | 9·079676 | 8 140 | 10·920324 | 9·082833 | 8 142 | 10·917167 | 10·003157 | 18 5 | 9·996843 | 24 | 6 |
| 30 | 38 | 9·080198 | 9 157 | 10·919802 | 9·083362 | 9 160 | 10·916638 | 10·003165 | 19 5 | 9·996835 | 22 | 30 |
| 55 | 40 | 9·080719 | 10 175 | 10·919281 | 9·083891 | 10 177 | 10·916109 | 10·003172 | 20 5 | 9·996828 | 20 | 5 |
| 30 | 42 | 9·081239 | 1 17 | 10·918761 | 9·084419 | 1 18 | 10·915581 | 10·003180 | 21 5 | 9·996820 | 18 | 30 |
| 56 | 44 | 9·081759 | 2 34 | 10·918241 | 9·084947 | 2 35 | 10·915053 | 10·003188 | 22 6 | 9·996812 | 16 | 4 |
| 30 | 46 | 9·082278 | 3 52 | 10·917722 | 9·085473 | 3 53 | 10·914527 | 10·003195 | 23 6 | 9·996805 | 14 | 30 |
| 57 | 48 | 9·082797 | 4 69 | 10·917203 | 9·086000 | 4 70 | 10·914000 | 10·003203 | 24 6 | 9·996797 | 12 | 3 |
| 30 | 50 | 9·083314 | 5 86 | 10·916685 | 9·086525 | 5 88 | 10·913475 | 10·003211 | 25 6 | 9·996789 | 10 | 30 |
| 58 | 52 | 9·083832 | 6 103 | 10·916168 | 9·087050 | 6 105 | 10·912950 | 10·003218 | 26 7 | 9·996782 | 8 | 2 |
| 30 | 54 | 9·084348 | 7 121 | 10·915652 | 9·087574 | 7 123 | 10·912426 | 10·003226 | 27 7 | 9·996774 | 6 | 30 |
| 59 | 56 | 9·084864 | 8 138 | 10·915136 | 9·088098 | 8 140 | 10·911902 | 10·003234 | 28 7 | 9·996766 | 4 | 1 |
| 30 | 58 | 9·085380 | 9 155 | 10·914620 | 9·088621 | 9 158 | 10·911379 | 10·003242 | 29 7 | 9·996758 | 2 | 30 |
| 60 | 28 | 9·085894 | 10 172 | 10·914106 | 9·089144 | 10 175 | 10·910856 | 10·003249 | 30 8 | 9·996751 | 0 | 0 |
| ′ ″ | m s | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m s | ′ ″ |

83° — 5h 32m.

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES. &c.

0ʰ 28ᵐ — 7°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·085894 | | 10·914106 | 9·089144 | | 10·910856 | 10·003249 | | 9·996751 | **32** | 60 |
| 30 | 2 | 9·086409 | 1″ 17 | 10·913591 | 9·089666 | 1″ 17 | 10·910334 | 10·003257 | 1″ 0 | 9·996743 | 58 | 30 |
| 1 | 4 | 9·086922 | 2 34 | 10·913078 | 9·090187 | 2 35 | 10·909813 | 10·003265 | 2 1 | 9·996735 | 56 | 59 |
| 30 | 6 | 9·087435 | 3 51 | 10·912565 | 9·090708 | 3 52 | 10·909292 | 10·003273 | 3 1 | 9·996727 | 54 | 30 |
| 2 | 8 | 9·087947 | 4 68 | 10·912053 | 9·091228 | 4 69 | 10·908772 | 10·003280 | 4 1 | 9·996720 | 52 | 58 |
| 30 | 10 | 9·088459 | 5 85 | 10·911541 | 9·091747 | 5 87 | 10·908253 | 10·003288 | 5 1 | 9·996712 | 50 | 30 |
| 3 | 12 | 9·088970 | 6 102 | 10·911030 | 9·092266 | 6 104 | 10·907734 | 10·003296 | 6 2 | 9·996704 | 48 | 57 |
| 30 | 14 | 9·089480 | 7 119 | 10·910520 | 9·092784 | 7 121 | 10·907216 | 10·003304 | 7 2 | 9·996696 | 46 | 30 |
| 4 | 16 | 9·089990 | 8 136 | 10·910010 | 9·093302 | 8 138 | 10·906698 | 10·003312 | 8 2 | 9·996688 | 44 | 56 |
| 30 | 18 | 9·090500 | 9 153 | 10·909500 | 9·093819 | 9 156 | 10·906181 | 10·003320 | 9 2 | 9·996681 | 42 | 30 |
| 5 | 20 | 9·091008 | 10 170 | 10·908992 | 9·094336 | 10 173 | 10·905664 | 10·003327 | 10 3 | 9·996673 | 40 | 55 |
| 30 | 22 | 9·091516 | 1 17 | 10·908484 | 9·094851 | 1 17 | 10·905149 | 10·003335 | 11 3 | 9·996665 | 38 | 30 |
| 6 | 24 | 9·092024 | 2 34 | 10·907976 | 9·095367 | 2 34 | 10·904633 | 10·003343 | 12 3 | 9·996657 | 36 | 54 |
| 30 | 26 | 9·092530 | 3 50 | 10·907470 | 9·095881 | 3 51 | 10·904119 | 10·003351 | 13 3 | 9·996649 | 34 | 30 |
| 7 | 28 | 9·093037 | 4 67 | 10·906963 | 9·096395 | 4 68 | 10·903605 | 10·003359 | 14 4 | 9·996641 | 32 | 53 |
| 30 | 30 | 9·093542 | 5 84 | 10·906458 | 9·096909 | 5 86 | 10·903091 | 10·003367 | 15 4 | 9·996633 | 30 | 30 |
| 8 | 32 | 9·094047 | 6 101 | 10·905953 | 9·097422 | 6 103 | 10·902578 | 10·003375 | 16 4 | 9·996625 | 28 | 52 |
| 30 | 34 | 9·094552 | 7 118 | 10·905448 | 9·097934 | 7 120 | 10·902066 | 10·003383 | 17 4 | 9·996618 | 26 | 30 |
| 9 | 36 | 9·095056 | 8 135 | 10·904944 | 9·098446 | 8 137 | 10·901554 | 10·003390 | 18 5 | 9·996610 | 24 | 51 |
| 30 | 38 | 9·095559 | 9 151 | 10·904441 | 9·098957 | 9 154 | 10·901043 | 10·003398 | 19 5 | 9·996602 | 22 | 30 |
| 10 | 40 | 9·096062 | 10 168 | 10·903938 | 9·099468 | 10 171 | 10·900532 | 10·003406 | 20 5 | 9·996594 | 20 | 50 |
| 30 | 42 | 9·096564 | 1 17 | 10·903436 | 9·099978 | 1 17 | 10·900022 | 10·003414 | 21 6 | 9·996586 | 18 | 30 |
| 11 | 44 | 9·097065 | 2 33 | 10·902935 | 9·100487 | 2 34 | 10·899513 | 10·003422 | 22 6 | 9·996578 | 16 | 49 |
| 30 | 46 | 9·097566 | 3 50 | 10·902434 | 9·100996 | 3 51 | 10·899004 | 10·003430 | 23 6 | 9·996570 | 14 | 30 |
| 12 | 48 | 9·098066 | 4 67 | 10·901934 | 9·101504 | 4 68 | 10·898496 | 10·003438 | 24 6 | 9·996562 | 12 | 48 |
| 30 | 50 | 9·098566 | 5 83 | 10·901434 | 9·102012 | 5 85 | 10·897988 | 10·003446 | 25 7 | 9·996554 | 10 | 30 |
| 13 | 52 | 9·099065 | 6 100 | 10·900935 | 9·102519 | 6 101 | 10·897481 | 10·003454 | 26 7 | 9·996546 | 8 | 47 |
| 30 | 54 | 9·099564 | 7 116 | 10·900436 | 9·103026 | 7 118 | 10·896974 | 10·003462 | 27 7 | 9·996538 | 6 | 30 |
| 14 | 56 | 9·100062 | 8 133 | 10·899938 | 9·103532 | 8 135 | 10·896468 | 10·003470 | 28 7 | 9·996530 | 4 | 46 |
| 30 | 58 | 9·100559 | 9 150 | 10·899441 | 9·104037 | 9 152 | 10·895963 | 10·003478 | 29 8 | 9·996522 | 2 | 30 |
| 15 | **29** | 9·101056 | 10 166 | 10·898944 | 9·104542 | 10 169 | 10·895458 | 10·003486 | 30 8 | 9·996514 | **31** | 45 |
| 30 | 2 | 9·101552 | 1 16 | 10·898448 | 9·105046 | 1 17 | 10·894954 | 10·003494 | 1 0 | 9·996506 | 58 | 30 |
| 16 | 4 | 9·102048 | 2 33 | 10·897952 | 9·105550 | 2 33 | 10·894450 | 10·003502 | 2 1 | 9·996498 | 56 | 44 |
| 30 | 6 | 9·102543 | 3 49 | 10·897457 | 9·106053 | 3 50 | 10·893947 | 10·003510 | 3 1 | 9·996490 | 54 | 30 |
| 17 | 8 | 9·103037 | 4 66 | 10·896963 | 9·106556 | 4 67 | 10·893444 | 10·003518 | 4 1 | 9·996482 | 52 | 43 |
| 30 | 10 | 9·103531 | 5 82 | 10·896469 | 9·107058 | 5 84 | 10·892942 | 10·003527 | 5 1 | 9·996474 | 50 | 30 |
| 18 | 12 | 9·104025 | 6 99 | 10·895975 | 9·107559 | 6 100 | 10·892441 | 10·003535 | 6 2 | 9·996465 | 48 | 42 |
| 30 | 14 | 9·104517 | 7 115 | 10·895483 | 9·108060 | 7 117 | 10·891940 | 10·003543 | 7 2 | 9·996457 | 46 | 30 |
| 19 | 16 | 9·105010 | 8 132 | 10·894990 | 9·108560 | 8 134 | 10·891440 | 10·003551 | 8 2 | 9·996449 | 44 | 41 |
| 30 | 18 | 9·105501 | 9 148 | 10·894499 | 9·109060 | 9 150 | 10·890940 | 10·003559 | 9 2 | 9·996441 | 42 | 30 |
| 20 | 20 | 9·105992 | 10 165 | 10·894008 | 9·109559 | 10 167 | 10·890441 | 10·003567 | 10 3 | 9·996433 | 40 | 40 |
| 30 | 22 | 9·106483 | 1 16 | 10·893517 | 9·110058 | 1 17 | 10·889942 | 10·003575 | 11 3 | 9·996425 | 38 | 30 |
| 21 | 24 | 9·106973 | 2 33 | 10·893027 | 9·110556 | 2 33 | 10·889444 | 10·003583 | 12 3 | 9·996417 | 36 | 39 |
| 30 | 26 | 9·107462 | 3 49 | 10·892538 | 9·111054 | 3 50 | 10·888946 | 10·003591 | 13 4 | 9·996409 | 34 | 30 |
| 22 | 28 | 9·107951 | 4 65 | 10·892049 | 9·111551 | 4 66 | 10·888449 | 10·003600 | 14 4 | 9·996400 | 32 | 38 |
| 30 | 30 | 9·108439 | 5 81 | 10·891561 | 9·112047 | 5 83 | 10·887953 | 10·003608 | 15 4 | 9·996392 | 30 | 30 |
| 23 | 32 | 9·108927 | 6 98 | 10·891073 | 9·112543 | 6 99 | 10·887457 | 10·003616 | 16 4 | 9·996384 | 28 | 37 |
| 30 | 34 | 9·109414 | 7 114 | 10·890586 | 9·113039 | 7 116 | 10·886961 | 10·003624 | 17 5 | 9·996376 | 26 | 30 |
| 24 | 36 | 9·109901 | 8 130 | 10·890099 | 9·113533 | 8 132 | 10·886467 | 10·003632 | 18 5 | 9·996368 | 24 | 36 |
| 30 | 38 | 9·110387 | 9 146 | 10·889613 | 9·114028 | 9 149 | 10·885972 | 10·003641 | 19 5 | 9·996359 | 22 | 30 |
| 25 | 40 | 9·110873 | 10 163 | 10·889127 | 9·114521 | 10 165 | 10·885479 | 10·003649 | 20 5 | 9·996351 | 20 | 35 |
| 30 | 42 | 9·111358 | 1 16 | 10·888642 | 9·115015 | 1 16 | 10·884985 | 10·003657 | 21 6 | 9·996343 | 18 | 30 |
| 26 | 44 | 9·111842 | 2 32 | 10·888158 | 9·115507 | 2 33 | 10·884493 | 10·003665 | 22 6 | 9·996335 | 16 | 34 |
| 30 | 46 | 9·112326 | 3 48 | 10·887674 | 9·115999 | 3 49 | 10·884001 | 10·003674 | 23 6 | 9·996327 | 14 | 30 |
| 27 | 48 | 9·112809 | 4 64 | 10·887191 | 9·116491 | 4 65 | 10·883509 | 10·003682 | 24 7 | 9·996318 | 12 | 33 |
| 30 | 50 | 9·113292 | 5 80 | 10·886708 | 9·116982 | 5 82 | 10·883018 | 10·003690 | 25 7 | 9·996310 | 10 | 30 |
| 28 | 52 | 9·113774 | 6 96 | 10·886226 | 9·117472 | 6 98 | 10·882528 | 10·003698 | 26 7 | 9·996302 | 8 | 32 |
| 30 | 54 | 9·114256 | 7 112 | 10·885744 | 9·117962 | 7 114 | 10·882038 | 10·003707 | 27 7 | 9·996293 | 6 | 20 |
| 29 | 56 | 9·114737 | 8 129 | 10·885263 | 9·118452 | 8 131 | 10·881548 | 10·003715 | 28 8 | 9·996285 | 4 | 31 |
| 30 | 58 | 9·115218 | 9 145 | 10·884782 | 9·118941 | 9 147 | 10·881059 | 10·003723 | 29 8 | 9·996277 | 2 | 30 |
| 30 | **30** | 9·115698 | 10 161 | 10·884302 | 9·119429 | 10 163 | 10·880571 | 10·003731 | 30 8 | 9·996269 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |

82° — 5ʰ 30ᵐ

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

7°

0h 30m

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·115698 | | 10·884302 | 9·119429 | | 10·880571 | 10·003731 | | 9·996269 | 30 | 30 |
| 30 | 2 | 9·116177 | 1″ 16 | 10·883823 | 9·119917 | 1″ 16 | 10·880083 | 10·003740 | 1″ 0 | 9·996260 | 58 | 30 |
| 31 | 4 | 9·116656 | 2 32 | 10·883344 | 9·120404 | 2 32 | 10·879596 | 10·003748 | 2 1 | 9·996252 | 56 | 29 |
| 30 | 6 | 9·117135 | 3 48 | 10·882865 | 9·120891 | 3 49 | 10·879109 | 10·003756 | 3 1 | 9·996244 | 54 | 30 |
| 32 | 8 | 9·117613 | 4 64 | 10·882387 | 9·121377 | 4 65 | 10·878623 | 10·003765 | 4 1 | 9·996235 | 52 | 28 |
| 30 | 10 | 9·118090 | 5 80 | 10·881910 | 9·121863 | 5 81 | 10·878137 | 10·003773 | 5 1 | 9·996227 | 50 | 30 |
| 33 | 12 | 9·118567 | 6 95 | 10·881433 | 9·122348 | 6 97 | 10·877652 | 10·003781 | 6 2 | 9·996219 | 48 | 27 |
| 30 | 14 | 9·119043 | 7 111 | 10·880957 | 9·122833 | 7 113 | 10·877167 | 10·003790 | 7 2 | 9·996210 | 46 | 30 |
| 34 | 16 | 9·119519 | 8 127 | 10·880481 | 9·123317 | 8 129 | 10·876683 | 10·003798 | 8 2 | 9·996202 | 44 | 26 |
| 30 | 18 | 9·119994 | 9 143 | 10·880006 | 9·123801 | 9 146 | 10·876199 | 10·003807 | 9 3 | 9·996193 | 42 | 30 |
| 35 | 20 | 9·120469 | 10 159 | 10·879531 | 9·124284 | 10 162 | 10·875716 | 10·003815 | 10 3 | 9·996185 | 40 | 25 |
| 30 | 22 | 9·120943 | 1 16 | 10·879057 | 9·124766 | 1 16 | 10·875234 | 10·003823 | 11 3 | 9·996177 | 38 | 30 |
| 36 | 24 | 9·121417 | 2 31 | 10·878583 | 9·125249 | 2 32 | 10·874751 | 10·003832 | 12 3 | 9·996168 | 36 | 24 |
| 30 | 26 | 9·121890 | 3 47 | 10·878110 | 9·125730 | 3 48 | 10·874270 | 10·003840 | 13 4 | 9·996160 | 34 | 30 |
| 37 | 28 | 9·122362 | 4 63 | 10·877638 | 9·126211 | 4 64 | 10·873789 | 10·003849 | 14 4 | 9·996151 | 32 | 23 |
| 30 | 30 | 9·122835 | 5 79 | 10·877165 | 9·126692 | 5 80 | 10·873308 | 10·003857 | 15 4 | 9·996143 | 30 | 30 |
| 38 | 32 | 9·123306 | 6 94 | 10·876694 | 9·127172 | 6 96 | 10·872828 | 10·003866 | 16 5 | 9·996134 | 28 | 22 |
| 30 | 34 | 9·123777 | 7 110 | 10·876223 | 9·127651 | 7 112 | 10·872349 | 10·003874 | 17 5 | 9·996126 | 26 | 30 |
| 39 | 36 | 9·124248 | 8 126 | 10·875752 | 9·128130 | 8 128 | 10·871870 | 10·003883 | 18 5 | 9·996117 | 24 | 21 |
| 30 | 38 | 9·124718 | 9 141 | 10·875282 | 9·128609 | 9 144 | 10·871391 | 10·003891 | 19 5 | 9·996109 | 22 | 30 |
| 40 | 40 | 9·125187 | 10 157 | 10·874813 | 9·129087 | 10 160 | 10·870913 | 10·003900 | 20 6 | 9·996100 | 20 | 20 |
| 30 | 42 | 9·125656 | 1 16 | 10·874344 | 9·129564 | 1 16 | 10·870436 | 10·003908 | 21 6 | 9·996092 | 18 | 30 |
| 41 | 44 | 9·126125 | 2 31 | 10·873875 | 9·130041 | 2 32 | 10·869959 | 10·003917 | 22 6 | 9·996083 | 16 | 19 |
| 30 | 46 | 9·126593 | 3 47 | 10·873407 | 9·130518 | 3 47 | 10·869482 | 10·003925 | 23 7 | 9·996075 | 14 | 30 |
| 42 | 48 | 9·127060 | 4 62 | 10·872940 | 9·130994 | 4 63 | 10·869006 | 10·003934 | 24 7 | 9·996066 | 12 | 18 |
| 30 | 50 | 9·127527 | 5 78 | 10·872473 | 9·131469 | 5 79 | 10·868531 | 10·003942 | 25 7 | 9·996058 | 10 | 30 |
| 43 | 52 | 9·127993 | 6 93 | 10·872007 | 9·131944 | 6 95 | 10·868056 | 10·003951 | 26 7 | 9·996049 | 8 | 17 |
| 30 | 54 | 9·128459 | 7 109 | 10·871541 | 9·132419 | 7 111 | 10·867581 | 10·003959 | 27 8 | 9·996041 | 6 | 30 |
| 44 | 56 | 9·128925 | 8 124 | 10·871075 | 9·132893 | 8 127 | 10·867107 | 10·003968 | 28 8 | 9·996032 | 4 | 16 |
| 30 | 58 | 9·129390 | 9 140 | 10·870610 | 9·133366 | 9 142 | 10·866634 | 10·003977 | 29 8 | 9·996023 | 2 | 30 |
| 45 | 31 | 9·129854 | 10 155 | 10·870146 | 9·133839 | 10 158 | 10·866161 | 10·003985 | 30 8 | 9·996015 | 29 | 15 |
| 30 | 2 | 9·130318 | 1 15 | 10·869682 | 9·134312 | 1 16 | 10·865688 | 10·003994 | 1 0 | 9·996006 | 58 | 30 |
| 46 | 4 | 9·130781 | 2 31 | 10·869219 | 9·134784 | 2 31 | 10·865216 | 10·004002 | 2 1 | 9·995998 | 56 | 14 |
| 30 | 6 | 9·131244 | 3 46 | 10·868756 | 9·135255 | 3 47 | 10·864745 | 10·004011 | 3 1 | 9·995989 | 54 | 30 |
| 47 | 8 | 9·131706 | 4 62 | 10·868294 | 9·135726 | 4 63 | 10·864274 | 10·004020 | 4 1 | 9·995980 | 52 | 13 |
| 30 | 10 | 9·132168 | 5 77 | 10·867832 | 9·136197 | 5 78 | 10·863803 | 10·004028 | 5 1 | 9·995972 | 50 | 30 |
| 48 | 12 | 9·132630 | 6 92 | 10·867370 | 9·136667 | 6 94 | 10·863333 | 10·004037 | 6 2 | 9·995963 | 48 | 12 |
| 30 | 14 | 9·133091 | 7 108 | 10·866909 | 9·137136 | 7 110 | 10·862864 | 10·004046 | 7 2 | 9·995954 | 46 | 30 |
| 49 | 16 | 9·133551 | 8 123 | 10·866449 | 9·137605 | 8 125 | 10·862395 | 10·004054 | 8 2 | 9·995946 | 44 | 11 |
| 30 | 18 | 9·134011 | 9 139 | 10·865989 | 9·138074 | 9 141 | 10·861926 | 10·004063 | 9 3 | 9·995937 | 42 | 30 |
| 50 | 20 | 9·134470 | 10 154 | 10·865530 | 9·138542 | 10 157 | 10·861458 | 10·004072 | 10 3 | 9·995928 | 40 | 10 |
| 30 | 22 | 9·134929 | 1 15 | 10·865071 | 9·139009 | 1 16 | 10·860991 | 10·004080 | 11 3 | 9·995920 | 38 | 30 |
| 51 | 24 | 9·135387 | 2 30 | 10·864613 | 9·139476 | 2 31 | 10·860524 | 10·004089 | 12 3 | 9·995911 | 36 | 9 |
| 30 | 26 | 9·135845 | 3 46 | 10·864155 | 9·139943 | 3 47 | 10·860057 | 10·004098 | 13 4 | 9·995902 | 34 | 30 |
| 52 | 28 | 9·136303 | 4 61 | 10·863697 | 9·140409 | 4 62 | 10·859591 | 10·004106 | 14 4 | 9·995894 | 32 | 8 |
| 30 | 30 | 9·136760 | 5 76 | 10·863240 | 9·140875 | 5 78 | 10·859125 | 10·004115 | 15 4 | 9·995885 | 30 | 30 |
| 53 | 32 | 9·137216 | 6 91 | 10·862784 | 9·141340 | 6 93 | 10·858660 | 10·004124 | 16 5 | 9·995876 | 28 | 7 |
| 30 | 34 | 9·137672 | 7 106 | 10·862328 | 9·141805 | 7 109 | 10·858195 | 10·004133 | 17 5 | 9·995867 | 26 | 30 |
| 54 | 36 | 9·138128 | 8 122 | 10·861872 | 9·142269 | 8 124 | 10·857731 | 10·004141 | 18 5 | 9·995859 | 24 | 6 |
| 30 | 38 | 9·138582 | 9 137 | 10·861418 | 9·142733 | 9 140 | 10·857267 | 10·004150 | 19 6 | 9·995850 | 22 | 30 |
| 55 | 40 | 9·139037 | 10 152 | 10·860963 | 9·143196 | 10 155 | 10·856804 | 10·004159 | 20 6 | 9·995841 | 20 | 5 |
| 30 | 42 | 9·139491 | 1 15 | 10·860509 | 9·143659 | 1 15 | 10·856341 | 10·004168 | 21 6 | 9·995832 | 18 | 30 |
| 56 | 44 | 9·139944 | 2 30 | 10·860056 | 9·144121 | 2 31 | 10·855879 | 10·004177 | 22 6 | 9·995823 | 16 | 4 |
| 30 | 46 | 9·140398 | 3 45 | 10·859602 | 9·144583 | 3 46 | 10·855417 | 10·004185 | 23 7 | 9·995815 | 14 | 30 |
| 57 | 48 | 9·140850 | 4 60 | 10·859150 | 9·145044 | 4 61 | 10·854956 | 10·004194 | 24 7 | 9·995806 | 12 | 3 |
| 30 | 50 | 9·141302 | 5 75 | 10·858698 | 9·145505 | 5 77 | 10·854495 | 10·004203 | 25 7 | 9·995797 | 10 | 30 |
| 58 | 52 | 9·141754 | 6 90 | 10·858246 | 9·145966 | 6 92 | 10·854034 | 10·004212 | 26 8 | 9·995788 | 8 | 2 |
| 30 | 54 | 9·142205 | 7 105 | 10·857795 | 9·146425 | 7 108 | 10·853575 | 10·004221 | 27 8 | 9·995779 | 6 | 30 |
| 59 | 56 | 9·142655 | 8 121 | 10·857345 | 9·146885 | 8 123 | 10·853115 | 10·004229 | 28 8 | 9·995771 | 4 | 1 |
| 30 | 58 | 9·143106 | 9 136 | 10·856894 | 9·147344 | 9 138 | 10·852656 | 10·004238 | 29 8 | 9·995762 | 2 | 30 |
| 60 | 32 | 9·143555 | 10 151 | 10·856445 | 9·147803 | 10 154 | 10·852197 | 10·004247 | 30 9 | 9·995753 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

82°

5h 28m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

0h 32m — 8°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·143555 | | 10·856445 | 9·147803 | | 10·852197 | 10·004247 | | 9·995753 | 28 | 60 |
| 30 | 2 | 9·144005 | 1″ 15 | 10·855995 | 9·148261 | 1″ 15 | 10·851739 | 10·004256 | 1″ 0 | 9·995744 | 58 | 30 |
| 1 | 4 | 9·144453 | 2 30 | 10·855547 | 9·148718 | 2 30 | 10·851282 | 10·004265 | 2 1 | 9·995735 | 56 | 59 |
| 30 | 6 | 9·144902 | 3 45 | 10·855098 | 9·149175 | 3 46 | 10·850825 | 10·004274 | 3 1 | 9·995726 | 54 | 30 |
| 2 | 8 | 9·145349 | 4 59 | 10·854651 | 9·149632 | 4 61 | 10·850368 | 10·004283 | 4 1 | 9·995717 | 52 | 58 |
| 30 | 10 | 9·145797 | 5 74 | 10·854203 | 9·150088 | 5 76 | 10·849912 | 10·004292 | 5 1 | 9·995708 | 50 | 30 |
| 3 | 12 | 9·146243 | 6 89 | 10·853757 | 9·150544 | 6 91 | 10·849456 | 10·004301 | 6 2 | 9·995699 | 48 | 57 |
| 30 | 14 | 9·146690 | 7 104 | 10·853310 | 9·151000 | 7 106 | 10·849000 | 10·004310 | 7 2 | 9·995690 | 46 | 30 |
| 4 | 16 | 9·147136 | 8 119 | 10·852864 | 9·151454 | 8 122 | 10·848546 | 10·004319 | 8 2 | 9·995681 | 44 | 56 |
| 30 | 18 | 9·147581 | 9 134 | 10·852419 | 9·151909 | 9 137 | 10·848091 | 10·004328 | 9 3 | 9·995672 | 42 | 30 |
| 5 | 20 | 9·148026 | 10 149 | 10·851974 | 9·152363 | 10 152 | 10·847637 | 10·004336 | 10 3 | 9·995664 | 40 | 55 |
| 30 | 22 | 9·148471 | 1 15 | 10·851529 | 9·152816 | 1 15 | 10·847184 | 10·004345 | 11 3 | 9·995655 | 38 | 30 |
| 6 | 24 | 9·148915 | 2 29 | 10·851085 | 9·153269 | 2 30 | 10·846731 | 10·004354 | 12 4 | 9·995646 | 36 | 54 |
| 30 | 26 | 9·149358 | 3 44 | 10·850642 | 9·153722 | 3 45 | 10·846278 | 10·004363 | 13 4 | 9·995637 | 34 | 30 |
| 7 | 28 | 9·149802 | 4 59 | 10·850198 | 9·154174 | 4 60 | 10·845826 | 10·004372 | 14 4 | 9·995628 | 32 | 53 |
| 30 | 30 | 9·150244 | 5 74 | 10·849756 | 9·154626 | 5 75 | 10·845374 | 10·004381 | 15 4 | 9·995619 | 30 | 30 |
| 8 | 32 | 9·150686 | 6 88 | 10·849314 | 9·155077 | 6 90 | 10·844923 | 10·004390 | 16 5 | 9·995610 | 28 | 52 |
| 30 | 34 | 9·151128 | 7 103 | 10·848872 | 9·155528 | 7 105 | 10·844472 | 10·004400 | 17 5 | 9·995601 | 26 | 30 |
| 9 | 36 | 9·151569 | 8 118 | 10·848431 | 9·155978 | 8 120 | 10·844022 | 10·004409 | 18 5 | 9·995591 | 24 | 51 |
| 30 | 38 | 9·152010 | 9 133 | 10·847990 | 9·156428 | 9 135 | 10·843572 | 10·004418 | 19 6 | 9·995582 | 22 | 30 |
| 10 | 40 | 9·152451 | 10 147 | 10·847549 | 9·156877 | 10 150 | 10·843123 | 10·004427 | 20 6 | 9·995573 | 20 | 50 |
| 30 | 42 | 9·152891 | 1 15 | 10·847109 | 9·157326 | 1 15 | 10·842674 | 10·004436 | 21 6 | 9·995564 | 18 | 30 |
| 11 | 44 | 9·153330 | 2 29 | 10·846670 | 9·157775 | 2 30 | 10·842225 | 10·004445 | 22 7 | 9·995555 | 16 | 49 |
| 30 | 46 | 9·153769 | 3 44 | 10·846231 | 9·158223 | 3 45 | 10·841777 | 10·004454 | 23 7 | 9·995546 | 14 | 30 |
| 12 | 48 | 9·154208 | 4 58 | 10·845792 | 9·158671 | 4 60 | 10·841329 | 10·004463 | 24 7 | 9·995537 | 12 | 48 |
| 30 | 50 | 9·154646 | 5 73 | 10·845354 | 9·159118 | 5 75 | 10·840882 | 10·004472 | 25 7 | 9·995528 | 10 | 30 |
| 13 | 52 | 9·155083 | 6 87 | 10·844917 | 9·159565 | 6 89 | 10·840435 | 10·004481 | 26 8 | 9·995519 | 8 | 47 |
| 30 | 54 | 9·155521 | 7 102 | 10·844479 | 9·160011 | 7 104 | 10·839989 | 10·004490 | 27 8 | 9·995510 | 6 | 39 |
| 14 | 56 | 9·155957 | 8 117 | 10·844043 | 9·160457 | 8 119 | 10·839543 | 10·004499 | 28 8 | 9·995501 | 4 | 46 |
| 30 | 58 | 9·156394 | 9 131 | 10·843606 | 9·160902 | 9 134 | 10·839098 | 10·004509 | 29 9 | 9·995491 | 2 | 30 |
| 15 | **33** | 9·156830 | 10 146 | 10·843170 | 9·161347 | 10 149 | 10·838653 | 10·004518 | 30 9 | 9·995482 | **27** | 45 |
| 30 | 2 | 9·157265 | 1 14 | 10·842735 | 9·161792 | 1 15 | 10·838208 | 10·004527 | 1 0 | 9·995473 | 58 | 30 |
| 16 | 4 | 9·157700 | 2 29 | 10·842300 | 9·162236 | 2 29 | 10·837764 | 10·004536 | 2 1 | 9·995464 | 56 | 44 |
| 30 | 6 | 9·158135 | 3 43 | 10·841865 | 9·162680 | 3 44 | 10·837320 | 10·004545 | 3 1 | 9·995455 | 54 | 30 |
| 17 | 8 | 9·158569 | 4 58 | 10·841431 | 9·163123 | 4 59 | 10·836877 | 10·004554 | 4 1 | 9·995446 | 52 | 43 |
| 30 | 10 | 9·159002 | 5 72 | 10·840998 | 9·163566 | 5 74 | 10·836434 | 10·004564 | 5 2 | 9·995436 | 50 | 30 |
| 18 | 12 | 9·159435 | 6 87 | 10·840565 | 9·164008 | 6 88 | 10·835992 | 10·004573 | 6 2 | 9·995427 | 48 | 42 |
| 30 | 14 | 9·159868 | 7 101 | 10·840132 | 9·164450 | 7 103 | 10·835550 | 10·004582 | 7 2 | 9·995418 | 46 | 30 |
| 19 | 16 | 9·160301 | 8 115 | 10·839699 | 9·164892 | 8 118 | 10·835108 | 10·004591 | 8 3 | 9·995409 | 44 | 41 |
| 30 | 18 | 9·160732 | 9 130 | 10·839268 | 9·165333 | 9 133 | 10·834667 | 10·004601 | 9 3 | 9·995399 | 42 | 30 |
| 20 | 20 | 9·161164 | 10 144 | 10·838836 | 9·165774 | 10 147 | 10·834226 | 10·004610 | 10 3 | 9·995390 | 40 | 40 |
| 30 | 22 | 9·161595 | 1 14 | 10·838405 | 9·166214 | 1 15 | 10·833786 | 10·004619 | 11 4 | 9·995381 | 38 | 30 |
| 21 | 24 | 9·162025 | 2 29 | 10·837975 | 9·166654 | 2 29 | 10·833346 | 10·004628 | 12 4 | 9·995372 | 36 | 39 |
| 30 | 26 | 9·162456 | 3 43 | 10·837544 | 9·167093 | 3 44 | 10·832907 | 10·004638 | 13 4 | 9·995362 | 34 | 30 |
| 22 | 28 | 9·162885 | 4 57 | 10·837115 | 9·167532 | 4 58 | 10·832468 | 10·004647 | 14 4 | 9·995353 | 32 | 38 |
| 30 | 30 | 9·163315 | 5 71 | 10·836685 | 9·167971 | 5 73 | 10·832029 | 10·004656 | 15 5 | 9·995344 | 30 | 30 |
| 23 | 32 | 9·163743 | 6 86 | 10·836257 | 9·168409 | 6 88 | 10·831591 | 10·004666 | 16 5 | 9·995334 | 28 | 37 |
| 30 | 34 | 9·164172 | 7 100 | 10·835828 | 9·168847 | 7 102 | 10·831153 | 10·004675 | 17 5 | 9·995325 | 26 | 30 |
| 24 | 36 | 9·164600 | 8 114 | 10·835400 | 9·169284 | 8 117 | 10·830716 | 10·004684 | 18 6 | 9·995316 | 24 | 36 |
| 30 | 38 | 9·165027 | 9 128 | 10·834973 | 9·169721 | 9 131 | 10·830279 | 10·004694 | 19 6 | 9·995307 | 22 | 30 |
| 25 | 40 | 9·165454 | 10 143 | 10·834546 | 9·170157 | 10 146 | 10·829843 | 10·004703 | 20 6 | 9·995297 | 20 | 35 |
| 30 | 42 | 9·165881 | 1 14 | 10·834119 | 9·170593 | 1 14 | 10·829407 | 10·004712 | 21 7 | 9·995288 | 18 | 30 |
| 26 | 44 | 9·166307 | 2 28 | 10·833693 | 9·171029 | 2 29 | 10·828971 | 10·004722 | 22 7 | 9·995278 | 16 | 34 |
| 30 | 46 | 9·166733 | 3 42 | 10·833267 | 9·171464 | 3 43 | 10·828536 | 10·004731 | 23 7 | 9·995269 | 14 | 30 |
| 27 | 48 | 9·167159 | 4 57 | 10·832841 | 9·171899 | 4 58 | 10·828101 | 10·004740 | 24 7 | 9·995260 | 12 | 33 |
| 30 | 50 | 9·167584 | 5 71 | 10·832416 | 9·172333 | 5 72 | 10·827667 | 10·004750 | 25 8 | 9·995250 | 10 | 30 |
| 28 | 52 | 9·168008 | 6 85 | 10·831992 | 9·172767 | 6 87 | 10·827233 | 10·004759 | 26 8 | 9·995241 | 8 | 32 |
| 30 | 54 | 9·168432 | 7 99 | 10·831568 | 9·173201 | 7 101 | 10·826799 | 10·004769 | 27 8 | 9·995232 | 6 | 30 |
| 29 | 56 | 9·168856 | 8 113 | 10·831144 | 9·173634 | 8 116 | 10·826366 | 10·004778 | 28 9 | 9·995222 | 4 | 31 |
| 30 | 58 | 9·169279 | 9 127 | 10·830721 | 9·174067 | 9 130 | 10·825933 | 10·004787 | 29 9 | 9·995213 | 2 | 30 |
| 30 | **34** | 9·169702 | 10 141 | 10·830298 | 9·174499 | 10 145 | 10·825501 | 10·004797 | 30 9 | 9·995203 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

81° — 5h 26m

## TABLE XXVI—(*continued*)

### LOG. SINES, COSINES, &c.

$0^h\ 34^m$ — 8°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·169702 | | 10·830298 | 9·174499 | | 10·825501 | 10·004797 | | 9·995203 | 26 | 30 |
| 30 | 2 | 9·170125 | 1″ 14 | 10·829875 | 9·174931 | 1″ 14 | 10·825069 | 10·004806 | 1″ 0 | 9·995194 | 58 | 30 |
| 31 | 4 | 9·170547 | 2 28 | 10·829453 | 9·175362 | 2 29 | 10·824638 | 10·004816 | 2 1 | 9·995184 | 56 | 29 |
| 30 | 6 | 9·170968 | 3 42 | 10·829032 | 9·175793 | 3 43 | 10·824207 | 10·004825 | 3 1 | 9·995175 | 54 | 30 |
| 32 | 8 | 9·171389 | 4 56 | 10·828611 | 9·176224 | 4 57 | 10·823776 | 10·004835 | 4 1 | 9·995165 | 52 | 28 |
| 30 | 10 | 9·171810 | 5 70 | 10·828190 | 9·176654 | 5 72 | 10·823346 | 10·004844 | 5 2 | 9·995156 | 50 | 30 |
| 33 | 12 | 9·172230 | 6 84 | 10·827770 | 9·177084 | 6 86 | 10·822916 | 10·004854 | 6 2 | 9·995146 | 48 | 27 |
| 30 | 14 | 9·172650 | 7 98 | 10·827350 | 9·177513 | 7 100 | 10·822487 | 10·004863 | 7 2 | 9·995137 | 46 | 30 |
| 34 | 16 | 9·173070 | 8 112 | 10·826930 | 9·177942 | 8 115 | 10·822058 | 10·004873 | 8 3 | 9·995127 | 44 | 26 |
| 30 | 18 | 9·173489 | 9 126 | 10·826511 | 9·178371 | 9 129 | 10·821629 | 10·004882 | 9 3 | 9·995118 | 42 | 30 |
| 35 | 20 | 9·173908 | 10 140 | 10·826092 | 9·178799 | 10 143 | 10·821201 | 10·004892 | 10 3 | 9·995108 | 40 | 25 |
| 30 | 22 | 9·174326 | 1 14 | 10·825674 | 9·179227 | 1 14 | 10·820773 | 10·004901 | 11 4 | 9·995099 | 38 | 30 |
| 36 | 24 | 9·174744 | 2 28 | 10·825256 | 9·179655 | 2 28 | 10·820345 | 10·004911 | 12 4 | 9·995089 | 36 | 24 |
| 30 | 26 | 9·175161 | 3 41 | 10·824839 | 9·180082 | 3 43 | 10·819918 | 10·004920 | 13 4 | 9·995080 | 34 | 30 |
| 37 | 28 | 9·175578 | 4 55 | 10·824422 | 9·180508 | 4 57 | 10·819492 | 10·004930 | 14 4 | 9·995070 | 32 | 23 |
| 30 | 30 | 9·175995 | 5 69 | 10·824005 | 9·180934 | 5 71 | 10·819066 | 10·004939 | 15 5 | 9·995061 | 30 | 30 |
| 38 | 32 | 9·176411 | 6 83 | 10·823589 | 9·181360 | 6 85 | 10·818640 | 10·004949 | 16 5 | 9·995051 | 28 | 22 |
| 30 | 34 | 9·176827 | 7 97 | 10·823173 | 9·181786 | 7 99 | 10·818214 | 10·004959 | 17 5 | 9·995041 | 26 | 30 |
| 39 | 36 | 9·177242 | 8 111 | 10·822758 | 9·182211 | 8 114 | 10·817789 | 10·004968 | 18 6 | 9·995032 | 24 | 21 |
| 30 | 38 | 9·177657 | 9 124 | 10·822343 | 9·182635 | 9 128 | 10·817365 | 10·004978 | 19 6 | 9·995022 | 22 | 30 |
| 40 | 40 | 9·178072 | 10 138 | 10·821928 | 9·183059 | 10 142 | 10·816941 | 10·004987 | 20 6 | 9·995013 | 20 | 20 |
| 30 | 42 | 9·178486 | 1 14 | 10·821514 | 9·183483 | 1 14 | 10·816517 | 10·004997 | 21 7 | 9·995003 | 18 | 30 |
| 41 | 44 | 9·178900 | 2 27 | 10·821100 | 9·183907 | 2 28 | 10·816093 | 10·005007 | 22 7 | 9·994993 | 16 | 19 |
| 30 | 46 | 9·179313 | 3 41 | 10·820687 | 9·184330 | 3 42 | 10·815670 | 10·005016 | 23 7 | 9·994984 | 14 | 30 |
| 42 | 48 | 9·179726 | 4 55 | 10·820274 | 9·184752 | 4 56 | 10·815248 | 10·005026 | 24 8 | 9·994974 | 12 | 18 |
| 30 | 50 | 9·180139 | 5 69 | 10·819861 | 9·185175 | 5 70 | 10·814825 | 10·005036 | 25 8 | 9·994964 | 10 | 30 |
| 43 | 52 | 9·180551 | 6 82 | 10·819449 | 9·185597 | 6 84 | 10·814403 | 10·005045 | 26 8 | 9·994955 | 8 | 17 |
| 30 | 54 | 9·180963 | 7 96 | 10·819037 | 9·186018 | 7 98 | 10·813982 | 10·005055 | 27 9 | 9·994945 | 6 | 30 |
| 44 | 56 | 9·181374 | 8 110 | 10·818626 | 9·186439 | 8 113 | 10·813561 | 10·005065 | 28 9 | 9·994935 | 4 | 16 |
| 30 | 58 | 9·181785 | 9 124 | 10·818215 | 9·186860 | 9 127 | 10·813140 | 10·005075 | 29 9 | 9·994925 | 2 | 30 |
| 45 | **35** | 9·182196 | 10 137 | 10·817804 | 9·187280 | 10 141 | 10·812720 | 10·005084 | 30 10 | 9·994916 | **25** | 15 |
| 30 | 2 | 9·182606 | 1 14 | 10·817394 | 9·187700 | 1 14 | 10·812300 | 10·005094 | 1 0 | 9·994906 | 58 | 30 |
| 46 | 4 | 9·183016 | 2 27 | 10·816984 | 9·188120 | 2 28 | 10·811880 | 10·005104 | 2 1 | 9·994896 | 56 | 14 |
| 30 | 6 | 9·183425 | 3 41 | 10·816575 | 9·188539 | 3 42 | 10·811461 | 10·005113 | 3 1 | 9·994887 | 54 | 30 |
| 47 | 8 | 9·183834 | 4 54 | 10·816166 | 9·188958 | 4 56 | 10·811042 | 10·005123 | 4 1 | 9·994877 | 52 | 13 |
| 30 | 10 | 9·184243 | 5 68 | 10·815757 | 9·189376 | 5 70 | 10·810624 | 10·005133 | 5 2 | 9·994867 | 50 | 30 |
| 48 | 12 | 9·184651 | 6 82 | 10·815349 | 9·189794 | 6 84 | 10·810206 | 10·005143 | 6 2 | 9·994857 | 48 | 12 |
| 30 | 14 | 9·185059 | 7 95 | 10·814941 | 9·190212 | 7 98 | 10·809788 | 10·005153 | 7 2 | 9·994847 | 46 | 30 |
| 49 | 16 | 9·185466 | 8 109 | 10·814534 | 9·190629 | 8 111 | 10·809371 | 10·005162 | 8 3 | 9·994838 | 44 | 11 |
| 30 | 18 | 9·185874 | 9 122 | 10·814126 | 9·191046 | 9 125 | 10·808954 | 10·005172 | 9 3 | 9·994828 | 42 | 30 |
| 50 | 20 | 9·186280 | 10 136 | 10·813720 | 9·191462 | 10 139 | 10·808538 | 10·005182 | 10 3 | 9·994818 | 40 | 10 |
| 30 | 22 | 9·186686 | 1 13 | 10·813314 | 9·191878 | 1 14 | 10·808122 | 10·005192 | 11 4 | 9·994808 | 38 | 30 |
| 51 | 24 | 9·187092 | 2 27 | 10·812908 | 9·192294 | 2 28 | 10·807706 | 10·005202 | 12 4 | 9·994798 | 36 | 9 |
| 30 | 26 | 9·187498 | 3 40 | 10·812502 | 9·192709 | 3 41 | 10·807291 | 10·005211 | 13 4 | 9·994789 | 34 | 30 |
| 52 | 28 | 9·187903 | 4 54 | 10·812097 | 9·193124 | 4 55 | 10·806876 | 10·005221 | 14 5 | 9·994779 | 32 | 8 |
| 30 | 30 | 9·188308 | 5 67 | 10·811692 | 9·193539 | 5 69 | 10·806461 | 10·005231 | 15 5 | 9·994769 | 30 | 30 |
| 53 | 32 | 9·188712 | 6 81 | 10·811288 | 9·193953 | 6 83 | 10·806047 | 10·005241 | 16 5 | 9·994759 | 28 | 7 |
| 30 | 34 | 9·189116 | 7 94 | 10·810884 | 9·194367 | 7 97 | 10·805633 | 10·005251 | 17 6 | 9·994749 | 26 | 30 |
| 54 | 36 | 9·189519 | 8 108 | 10·810481 | 9·194780 | 8 110 | 10·805220 | 10·005261 | 18 6 | 9·994739 | 24 | 6 |
| 30 | 38 | 9·189923 | 9 121 | 10·810077 | 9·195193 | 9 124 | 10·804807 | 10·005271 | 19 6 | 9·994729 | 22 | 30 |
| 55 | 40 | 9·190325 | 10 135 | 10·809675 | 9·195606 | 10 138 | 10·804394 | 10·005280 | 20 7 | 9·994720 | 20 | 5 |
| 30 | 42 | 9·190728 | 1 13 | 10·809272 | 9·196018 | 1 14 | 10·803982 | 10·005290 | 21 7 | 9·994710 | 18 | 30 |
| 56 | 44 | 9·191130 | 2 27 | 10·808870 | 9·196430 | 2 27 | 10·803570 | 10·005300 | 22 7 | 9·994700 | 16 | 4 |
| 30 | 46 | 9·191532 | 3 40 | 10·808468 | 9·196842 | 3 41 | 10·803158 | 10·005310 | 23 8 | 9·994690 | 14 | 30 |
| 57 | 48 | 9·191933 | 4 53 | 10·808067 | 9·197253 | 4 55 | 10·802747 | 10·005320 | 24 8 | 9·994680 | 12 | 3 |
| 30 | 50 | 9·192334 | 5 67 | 10·807666 | 9·197664 | 5 68 | 10·802336 | 10·005330 | 25 8 | 9·994670 | 10 | 30 |
| 58 | 52 | 9·192734 | 6 80 | 10·807266 | 9·198074 | 6 82 | 10·801926 | 10·005340 | 26 9 | 9·994660 | 8 | 2 |
| 30 | 54 | 9·193134 | 7 93 | 10·806866 | 9·198484 | 7 96 | 10·801516 | 10·005350 | 27 9 | 9·994650 | 6 | 30 |
| 59 | 56 | 9·193534 | 8 107 | 10·806466 | 9·198894 | 8 109 | 10·801106 | 10·005360 | 28 9 | 9·994640 | 4 | 1 |
| 30 | 58 | 9·193933 | 9 120 | 10·806067 | 9·199304 | 9 123 | 10·800696 | 10·005370 | 29 10 | 9·994630 | 2 | 30 |
| 60 | **36** | 9·194332 | 10 133 | 10·805668 | 9·199713 | 10 137 | 10·800287 | 10·005380 | 30 10 | 9·994620 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

81° — $5^h\ 24^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES. &c.

$0^h\ 36^m$ 9°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 4 | 9·194332 | | 10·805668 | 9·199713 | | 10·800287 | 10·005380 | | 9·994620 | 24 | 60 |
| 30 | 2 | 9·194731 | 1″ 13 | 10·805269 | 9·200121 | 1″ 13 | 10·799879 | 10·005390 | 1″ 0 | 9·994610 | 58 | 30 |
| 1 | 4 | 9·195129 | 2 26 | 10·804871 | 9·200529 | 2 27 | 10·799471 | 10·005400 | 2 1 | 9·994600 | 56 | 59 |
| 30 | 6 | 9·195527 | 3 39 | 10·804473 | 9·200937 | 3 40 | 10·799063 | 10·005410 | 3 1 | 9·994590 | 54 | 30 |
| 2 | 8 | 9·195925 | 4 52 | 10·804075 | 9·201345 | 4 54 | 10·798655 | 10·005420 | 4 1 | 9·994580 | 52 | 58 |
| 30 | 10 | 9·196322 | 5 65 | 10·803678 | 9·201752 | 5 67 | 10·798248 | 10·005430 | 5 2 | 9·994570 | 50 | 30 |
| 3 | 12 | 9·196719 | 6 79 | 10·803281 | 9·202159 | 6 81 | 10·797841 | 10·005440 | 6 2 | 9·994560 | 48 | 57 |
| 30 | 14 | 9·197115 | 7 92 | 10·802885 | 9·202565 | 7 94 | 10·797435 | 10·005450 | 7 2 | 9·994550 | 46 | 20 |
| 4 | 16 | 9·197511 | 8 105 | 10·802489 | 9·202971 | 8 108 | 10·797029 | 10·005460 | 8 3 | 9·994540 | 44 | 56 |
| 30 | 18 | 9·197907 | 9 118 | 10·802093 | 9·203377 | 9 121 | 10·796623 | 10·005470 | 9 3 | 9·994530 | 42 | 30 |
| 5 | 20 | 9·198302 | 10 131 | 10·801698 | 9·203782 | 10 134 | 10·796218 | 10·005481 | 10 3 | 9·994519 | 40 | 55 |
| 30 | 22 | 9·198697 | 11 144 | 10·801303 | 9·204188 | 11 148 | 10·795812 | 10·005491 | 11 4 | 9·994509 | 38 | 30 |
| 6 | 24 | 9·199091 | 12 157 | 10·800909 | 9·204592 | 12 161 | 10·795408 | 10·005501 | 12 4 | 9·994499 | 36 | 54 |
| 30 | 26 | 9·199486 | 13 170 | 10·800514 | 9·204996 | 13 175 | 10·795004 | 10·005511 | 13 4 | 9·994489 | 34 | 30 |
| 7 | 28 | 9·199879 | 14 183 | 10·800121 | 9·205400 | 14 188 | 10·794600 | 10·005521 | 14 5 | 9·994479 | 32 | 53 |
| 30 | 30 | 9·200273 | 15 197 | 10·799727 | 9·205804 | 15 201 | 10·794196 | 10·005531 | 15 5 | 9·994469 | 30 | 30 |
| 8 | 32 | 9·200666 | 16 210 | 10·799334 | 9·206207 | 16 215 | 10·793793 | 10·005541 | 16 5 | 9·994459 | 28 | 52 |
| 30 | 34 | 9·201059 | 17 223 | 10·798941 | 9·206610 | 17 229 | 10·793390 | 10·005552 | 17 6 | 9·994448 | 26 | 30 |
| 9 | 36 | 9·201451 | 18 236 | 10·798549 | 9·207013 | 18 242 | 10·792987 | 10·005562 | 18 6 | 9·994438 | 24 | 51 |
| 30 | 38 | 9·201843 | 19 249 | 10·798157 | 9·207415 | 19 255 | 10·792585 | 10·005572 | 19 6 | 9·994428 | 22 | 30 |
| 10 | 40 | 9·202234 | 20 262 | 10·797766 | 9·207817 | 20 269 | 10·792183 | 10·005582 | 20 7 | 9·994418 | 20 | 50 |
| 30 | 42 | 9·202626 | 21 275 | 10·797374 | 9·208218 | 21 282 | 10·791782 | 10·005592 | 21 7 | 9·994408 | 18 | 30 |
| 11 | 44 | 9·203017 | 22 288 | 10·796983 | 9·208619 | 22 295 | 10·791381 | 10·005602 | 22 7 | 9·994398 | 16 | 49 |
| 30 | 46 | 9·203407 | 23 301 | 10·796593 | 9·209020 | 23 309 | 10·790980 | 10·005613 | 23 8 | 9·994387 | 14 | 30 |
| 12 | 48 | 9·203797 | 24 315 | 10·796203 | 9·209420 | 24 323 | 10·790580 | 10·005623 | 24 8 | 9·994377 | 12 | 48 |
| 30 | 50 | 9·204187 | 25 328 | 10·795813 | 9·209820 | 25 336 | 10·790180 | 10·005633 | 25 8 | 9·994367 | 10 | 30 |
| 13 | 52 | 9·204577 | 26 341 | 10·795423 | 9·210220 | 26 350 | 10·789780 | 10·005643 | 26 9 | 9·994357 | 8 | 47 |
| 30 | 54 | 9·204966 | 27 354 | 10·795034 | 9·210619 | 27 363 | 10·789381 | 10·005654 | 27 9 | 9·994346 | 6 | 30 |
| 14 | 56 | 9·205354 | 28 367 | 10·794646 | 9·211018 | 28 376 | 10·788982 | 10·005664 | 28 9 | 9·994336 | 4 | 46 |
| 30 | 58 | 9·205743 | 29 380 | 10·794257 | 9·211417 | 29 390 | 10·788583 | 10·005674 | 29 10 | 9·994326 | 2 | 30 |
| 15 | 37 | 9·206131 | 30 393 | 10·793869 | 9·211815 | 30 403 | 10·788185 | 10·005684 | 30 10 | 9·994316 | 23 | 45 |
| 30 | 2 | 9·206519 | 1 13 | 10·793481 | 9·212213 | 1 13 | 10·787787 | 10·005695 | 1 0 | 9·994305 | 58 | 30 |
| 16 | 4 | 9·206906 | 2 25 | 10·793094 | 9·212611 | 2 26 | 10·787389 | 10·005705 | 2 1 | 9·994295 | 56 | 44 |
| 30 | 6 | 9·207293 | 3 38 | 10·792707 | 9·213008 | 3 39 | 10·786992 | 10·005715 | 3 1 | 9·994285 | 54 | 30 |
| 17 | 8 | 9·207679 | 4 51 | 10·792321 | 9·213405 | 4 52 | 10·786595 | 10·005726 | 4 1 | 9·994274 | 52 | 43 |
| 30 | 10 | 9·208066 | 5 64 | 10·791934 | 9·213802 | 5 65 | 10·786198 | 10·005736 | 5 2 | 9·994264 | 50 | 30 |
| 18 | 12 | 9·208452 | 6 76 | 10·791548 | 9·214198 | 6 79 | 10·785802 | 10·005746 | 6 2 | 9·994254 | 48 | 42 |
| 30 | 14 | 9·208837 | 7 89 | 10·791163 | 9·214594 | 7 92 | 10·785406 | 10·005757 | 7 2 | 9·994243 | 46 | 30 |
| 19 | 16 | 9·209222 | 8 102 | 10·790778 | 9·214989 | 8 105 | 10·785011 | 10·005767 | 8 3 | 9·994233 | 44 | 41 |
| 30 | 18 | 9·209607 | 9 115 | 10·790393 | 9·215385 | 9 118 | 10·784615 | 10·005777 | 9 3 | 9·994223 | 42 | 30 |
| 20 | 20 | 9·209992 | 10 127 | 10·790008 | 9·215780 | 10 131 | 10·784220 | 10·005788 | 10 3 | 9·994212 | 40 | 40 |
| 30 | 22 | 9·210376 | 11 140 | 10·789624 | 9·216174 | 11 144 | 10·783826 | 10·005798 | 11 4 | 9·994202 | 38 | 30 |
| 21 | 24 | 9·210760 | 12 153 | 10·789240 | 9·216568 | 12 157 | 10·783432 | 10·005809 | 12 4 | 9·994191 | 36 | 39 |
| 30 | 26 | 9·211143 | 13 166 | 10·788857 | 9·216962 | 13 170 | 10·783038 | 10·005819 | 13 4 | 9·994181 | 34 | 30 |
| 22 | 28 | 9·211526 | 14 178 | 10·788474 | 9·217356 | 14 183 | 10·782644 | 10·005829 | 14 5 | 9·994171 | 32 | 38 |
| 30 | 30 | 9·211909 | 15 191 | 10·788091 | 9·217749 | 15 196 | 10·782251 | 10·005840 | 15 5 | 9·994160 | 30 | 30 |
| 23 | 32 | 9·212291 | 16 204 | 10·787709 | 9·218142 | 16 210 | 10·781858 | 10·005850 | 16 5 | 9·994150 | 28 | 37 |
| 30 | 34 | 9·212674 | 17 217 | 10·787326 | 9·218534 | 17 223 | 10·781466 | 10·005861 | 17 6 | 9·994139 | 26 | 30 |
| 24 | 36 | 9·213055 | 18 229 | 10·786945 | 9·218926 | 18 236 | 10·781074 | 10·005871 | 18 6 | 9·994129 | 24 | 36 |
| 30 | 38 | 9·213437 | 19 242 | 10·786563 | 9·219318 | 19 249 | 10·780682 | 10·005882 | 19 6 | 9·994118 | 22 | 30 |
| 25 | 40 | 9·213818 | 20 255 | 10·786182 | 9·219710 | 20 262 | 10·780290 | 10·005892 | 20 7 | 9·994108 | 20 | 35 |
| 30 | 42 | 9·214198 | 21 268 | 10·785802 | 9·220101 | 21 275 | 10·779899 | 10·005903 | 21 7 | 9·994097 | 18 | 30 |
| 26 | 44 | 9·214579 | 22 280 | 10·785421 | 9·220492 | 22 288 | 10·779508 | 10·005913 | 22 7 | 9·994087 | 16 | 34 |
| 30 | 46 | 9·214959 | 23 293 | 10·785041 | 9·220882 | 23 301 | 10·779118 | 10·005924 | 23 8 | 9·994076 | 14 | 30 |
| 27 | 48 | 9·215338 | 24 306 | 10·784662 | 9·221272 | 24 314 | 10·778728 | 10·005934 | 24 8 | 9·994066 | 12 | 33 |
| 30 | 50 | 9·215718 | 25 319 | 10·784282 | 9·221662 | 25 327 | 10·778338 | 10·005945 | 25 8 | 9·994055 | 10 | 30 |
| 28 | 52 | 9·216097 | 26 331 | 10·783903 | 9·222052 | 26 341 | 10·777948 | 10·005955 | 26 9 | 9·994045 | 8 | 32 |
| 30 | 54 | 9·216475 | 27 344 | 10·783525 | 9·222441 | 27 354 | 10·777559 | 10·005966 | 27 9 | 9·994034 | 6 | 30 |
| 29 | 56 | 9·216854 | 28 357 | 10·783146 | 9·222830 | 28 367 | 10·777170 | 10·005976 | 28 10 | 9·994024 | 4 | 31 |
| 30 | 58 | 9·217232 | 29 370 | 10·782768 | 9·223218 | 29 380 | 10·776782 | 10·005987 | 29 10 | 9·994013 | 2 | 30 |
| 30 | 38 | 9·217609 | 30 382 | 10·782391 | 9·223607 | 30 393 | 10·776393 | 10·005997 | 30 10 | 9·994003 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

80° $5^h\ 22^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0ʰ 38ᵐ 9°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·217609 | | 10·782391 | 9·223607 | | 10·776393 | 10·005997 | | 9·994003 | 22 | 30 |
| 30 | 2 | 9·217987 | 1″ 12 | 10·782013 | 9·223994 | 1″ 13 | 10·776006 | 10·006008 | 1″ 0 | 9·993992 | 58 | 30 |
| 31 | 4 | 9·218363 | 2 25 | 10·781637 | 9·224382 | 2 25 | 10·775618 | 10·006018 | 2 1 | 9·993982 | 56 | 29 |
| 30 | 6 | 9·218740 | 3 37 | 10·781260 | 9·224769 | 3 38 | 10 775231 | 10·006029 | 3 1 | 9·993971 | 54 | 30 |
| 32 | 8 | 9·219116 | 4 50 | 10·780884 | 9·225156 | 4 51 | 10·774844 | 10·006040 | 4 1 | 9·993960 | 52 | 28 |
| 30 | 10 | 9·219492 | 5 62 | 10·780508 | 9·225543 | 5 64 | 10·774457 | 10·006050 | 5 2 | 9·993950 | 50 | 30 |
| 33 | 12 | 9·219868 | 6 74 | 10·780132 | 9·225929 | 6 77 | 10·774071 | 10·006061 | 6 2 | 9·993939 | 48 | 27 |
| 30 | 14 | 9·220243 | 7 87 | 10·779757 | 9·226315 | 7 90 | 10·773685 | 10·006072 | 7 2 | 9·993928 | 46 | 30 |
| 34 | 16 | 9·220618 | 8 99 | 10·779382 | 9·226700 | 8 102 | 10·773300 | 10·006082 | 8 3 | 9·993918 | 44 | 26 |
| 30 | 18 | 9·220993 | 9 112 | 10·779007 | 9·227086 | 9 115 | 10·772914 | 10·006093 | 9 3 | 9·993907 | 42 | 30 |
| 35 | 20 | 9·221367 | 10 124 | 10·778633 | 9·227471 | 10 128 | 10·772529 | 10·006103 | 10 4 | 9·993897 | 40 | 25 |
| 30 | 22 | 9·221741 | 11 136 | 10·778259 | 9·227855 | 11 140 | 10·772145 | 10·006114 | 11 4 | 9·993886 | 38 | 30 |
| 36 | 24 | 9·222115 | 12 149 | 10·777885 | 9·228239 | 12 153 | 10·771761 | 10·006125 | 12 4 | 9·993875 | 36 | 24 |
| 30 | 26 | 9·222488 | 13 161 | 10·777512 | 9·228623 | 13 166 | 10·771377 | 10·006136 | 13 5 | 9·993864 | 34 | 30 |
| 37 | 28 | 9·222861 | 14 174 | 10·777139 | 9·229007 | 14 179 | 10·770993 | 10·006146 | 14 5 | 9·993854 | 32 | 23 |
| 30 | 30 | 9·223234 | 15 186 | 10·776766 | 9·229390 | 15 192 | 10·770610 | 10·006157 | 15 5 | 9·993843 | 30 | 30 |
| 38 | 32 | 9·223606 | 16 198 | 10·776394 | 9·229773 | 16 204 | 10·770227 | 10·006168 | 16 6 | 9·993832 | 28 | 22 |
| 30 | 34 | 9·223978 | 17 211 | 10·776022 | 9·230156 | 17 217 | 10·769844 | 10·006178 | 17 6 | 9·993822 | 26 | 30 |
| 39 | 36 | 9·224349 | 18 223 | 10·775651 | 9·230539 | 18 230 | 10·769461 | 10·006189 | 18 6 | 9·993811 | 24 | 21 |
| 30 | 38 | 9·224721 | 19 236 | 10·775279 | 9·230921 | 19 243 | 10·769079 | 10·006200 | 19 7 | 9·993800 | 22 | 30 |
| 40 | 40 | 9·225092 | 20 248 | 10·774908 | 9·231302 | 20 255 | 10·768698 | 10·006211 | 20 7 | 9·993789 | 20 | 20 |
| 30 | 42 | 9·225462 | 21 261 | 10·774538 | 9·231684 | 21 268 | 10·768316 | 10·006221 | 21 7 | 9·993779 | 18 | 30 |
| 41 | 44 | 9·225833 | 22 273 | 10·774167 | 9·232065 | 22 281 | 10·767935 | 10·006232 | 22 8 | 9·993768 | 16 | 19 |
| 30 | 46 | 9·226203 | 23 286 | 10·773797 | 9·232446 | 23 294 | 10·767554 | 10·006243 | 23 8 | 9·993757 | 14 | 30 |
| 42 | 48 | 9·226573 | 24 298 | 10·773427 | 9·232826 | 24 307 | 10·767174 | 10·006254 | 24 9 | 9·993746 | 12 | 18 |
| 30 | 50 | 9·226942 | 25 310 | 10·773058 | 9·233206 | 25 320 | 10·766794 | 10·006265 | 25 9 | 9·993735 | 10 | 30 |
| 43 | 52 | 9·227311 | 26 323 | 10·772689 | 9·233586 | 26 332 | 10·766414 | 10·006275 | 26 9 | 9·993725 | 8 | 17 |
| 30 | 54 | 9·227680 | 27 335 | 10·772320 | 9·233966 | 27 345 | 10·766034 | 10·006286 | 27 10 | 9·993714 | 6 | 30 |
| 44 | 56 | 9·228048 | 28 348 | 10·771952 | 9·234345 | 28 358 | 10·765655 | 10·006297 | 28 10 | 9·993703 | 4 | 16 |
| 30 | 58 | 9·228416 | 29 360 | 10·771584 | 9·234724 | 29 371 | 10·765276 | 10·006308 | 29 10 | 9·993692 | 2 | 30 |
| 45 | **39** | 9·228784 | 30 372 | 10·771216 | 9·235103 | 30 383 | 10·764897 | 10·006319 | 30 11 | 9·993681 | **21** | 15 |
| 30 | 2 | 9·229151 | 1 12 | 10·770849 | 9·235481 | 1 12 | 10·764519 | 10·006330 | 1 0 | 9·993670 | 58 | 30 |
| 46 | 4 | 9·229518 | 2 24 | 10·770482 | 9·235859 | 2 25 | 10·764141 | 10·006340 | 2 1 | 9·993660 | 56 | 14 |
| 30 | 6 | 9·229885 | 3 36 | 10·770115 | 9·236237 | 3 37 | 10·763763 | 10·006351 | 3 1 | 9·993649 | 54 | 30 |
| 47 | 8 | 9·230252 | 4 48 | 10·769748 | 9·236614 | 4 50 | 10·763386 | 10·006362 | 4 1 | 9·993638 | 52 | 13 |
| 30 | 10 | 9·230618 | 5 60 | 10·769382 | 9·236991 | 5 62 | 10·763009 | 10·006373 | 5 2 | 9·993627 | 50 | 30 |
| 48 | 12 | 9·230984 | 6 73 | 10·769016 | 9·237368 | 6 75 | 10·762632 | 10·006384 | 6 2 | 9·993616 | 48 | 12 |
| 30 | 14 | 9·231349 | 7 85 | 10·768651 | 9·237744 | 7 87 | 10·762256 | 10·006395 | 7 3 | 9·993605 | 46 | 30 |
| 49 | 16 | 9·231715 | 8 97 | 10·768285 | 9·238120 | 8 100 | 10·761880 | 10·006406 | 8 3 | 9·993594 | 44 | 11 |
| 30 | 18 | 9·232079 | 9 109 | 10·767921 | 9·238496 | 9 112 | 10·761504 | 10·006417 | 9 3 | 9·993583 | 42 | 30 |
| 50 | 20 | 9·232444 | 10 121 | 10·767556 | 9·238872 | 10 125 | 10·761128 | 10·006428 | 10 4 | 9·993572 | 40 | 10 |
| 30 | 22 | 9·232808 | 11 133 | 10·767192 | 9·239247 | 11 137 | 10·760753 | 10·006439 | 11 4 | 9·993561 | 38 | 30 |
| 51 | 24 | 9·233172 | 12 145 | 10·766828 | 9·239622 | 12 150 | 10·760378 | 10·006450 | 12 4 | 9·993550 | 36 | 9 |
| 30 | 26 | 9·233536 | 13 157 | 10·766464 | 9·239996 | 13 162 | 10·760004 | 10·006461 | 13 5 | 9·993539 | 34 | 30 |
| 52 | 28 | 9·233899 | 14 169 | 10·766101 | 9·240371 | 14 175 | 10·759629 | 10·006472 | 14 5 | 9·993528 | 32 | 8 |
| 30 | 30 | 9·234262 | 15 181 | 10·765738 | 9·240745 | 15 187 | 10·759255 | 10·006483 | 15 6 | 9·993517 | 30 | 30 |
| 53 | 32 | 9·234625 | 16 193 | 10·765375 | 9·241118 | 16 200 | 10·758882 | 10·006494 | 16 6 | 9·993506 | 28 | 7 |
| 30 | 34 | 9·234987 | 17 206 | 10·765013 | 9·241492 | 17 212 | 10·758508 | 10·006505 | 17 7 | 9·993495 | 26 | 30 |
| 54 | 36 | 9·235349 | 18 218 | 10·764651 | 9·241865 | 18 224 | 10·758135 | 10·006516 | 18 7 | 9·993484 | 24 | 6 |
| 30 | 38 | 9·235711 | 19 230 | 10·764289 | 9·242238 | 19 237 | 10·757762 | 10·006527 | 19 7 | 9·993473 | 22 | 30 |
| 55 | 40 | 9·236073 | 20 242 | 10·763927 | 9·242610 | 20 249 | 10·757390 | 10·006538 | 20 7 | 9·993462 | 20 | 5 |
| 30 | 42 | 9·236434 | 21 254 | 10·763566 | 9·242982 | 21 261 | 10·757018 | 10·006549 | 21 8 | 9·993451 | 18 | 30 |
| 56 | 44 | 9·236795 | 22 266 | 10·763205 | 9·243354 | 22 274 | 10·756646 | 10·006560 | 22 8 | 9·993440 | 16 | 4 |
| 30 | 46 | 9·237155 | 23 278 | 10·762845 | 9·243726 | 23 286 | 10·756274 | 10·006571 | 23 8 | 9·993429 | 14 | 30 |
| 57 | 48 | 9·237515 | 24 290 | 10·762485 | 9·244097 | 24 299 | 10·755903 | 10·006582 | 24 9 | 9·993418 | 12 | 3 |
| 30 | 50 | 9·237875 | 25 302 | 10·762125 | 9·244468 | 25 311 | 10·755532 | 10·006593 | 25 9 | 9·993407 | 10 | 30 |
| 58 | 52 | 9·238235 | 26 314 | 10·761765 | 9·244839 | 26 323 | 10·755161 | 10·006604 | 26 9 | 9·993396 | 8 | 2 |
| 30 | 54 | 9·238594 | 27 327 | 10·761406 | 9·245209 | 27 336 | 10·754791 | 10·006615 | 27 10 | 9·993385 | 6 | 30 |
| 59 | 56 | 9·238953 | 28 338 | 10·761047 | 9·245579 | 28 348 | 10·754421 | 10·006626 | 28 10 | 9·993374 | 4 | 1 |
| 30 | 58 | 9·239312 | 29 351 | 10·760688 | 9·245949 | 29 361 | 10·754051 | 10·006637 | 29 11 | 9·993363 | 2 | 30 |
| 60 | **40** | 9·239670 | 30 363 | 10·760330 | 9·246319 | 30 374 | 10·753681 | 10·006649 | 30 11 | 9·993351 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

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## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0ʰ 40ᵐ — 10°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·239670 | | 10·760330 | 9·246319 | | 10·753681 | 10·006649 | | 9·993351 | 20 | 60 |
| 30 | 2 | 9·240028 | 1″ 12 | 10·759972 | 9·246688 | 1″ 12 | 10·753312 | 10·006660 | 1″ 0 | 9·993340 | 58 | 30 |
| 1 | 4 | 9·240386 | 2 24 | 10·759614 | 9·247057 | 2 24 | 10·752943 | 10·006671 | 2 1 | 9·993329 | 56 | 59 |
| 30 | 6 | 9·240744 | 3 35 | 10·759256 | 9·247426 | 3 36 | 10·752574 | 10·006682 | 3 1 | 9·993318 | 54 | 30 |
| 2 | 8 | 9·241101 | 4 47 | 10·758899 | 9·247794 | 4 49 | 10·752206 | 10·006693 | 4 2 | 9·993307 | 52 | 58 |
| 30 | 10 | 9·241458 | 5 59 | 10·758542 | 9·248162 | 5 61 | 10·751838 | 10·006704 | 5 2 | 9·993296 | 50 | 30 |
| 3 | 12 | 9·241814 | 6 71 | 10·758186 | 9·248530 | 6 73 | 10·751470 | 10·006716 | 6 2 | 9·993284 | 48 | 57 |
| 30 | 14 | 9·242170 | 7 83 | 10·757830 | 9·248897 | 7 85 | 10·751103 | 10·006727 | 7 3 | 9·993273 | 46 | 30 |
| 4 | 16 | 9·242526 | 8 94 | 10·757474 | 9·249264 | 8 97 | 10·750736 | 10·006738 | 8 3 | 9·993262 | 44 | 56 |
| 30 | 18 | 9·242882 | 9 106 | 10·757118 | 9·249631 | 9 110 | 10·750369 | 10·006749 | 9 3 | 9·993251 | 42 | 30 |
| 5 | 20 | 9·243237 | 10 118 | 10·756763 | 9·249998 | 10 122 | 10·750002 | 10·006760 | 10 4 | 9·993240 | 40 | 55 |
| 30 | 22 | 9·243592 | 11 130 | 10·756408 | 9·250364 | 11 134 | 10·749636 | 10·006772 | 11 4 | 9·993228 | 38 | 30 |
| 6 | 24 | 9·243947 | 12 141 | 10·756053 | 9·250730 | 12 146 | 10·749270 | 10·006783 | 12 5 | 9·993217 | 36 | 54 |
| 30 | 26 | 9·244302 | 13 153 | 10·755698 | 9·251096 | 13 158 | 10·748904 | 10·006794 | 13 5 | 9·993206 | 34 | 30 |
| 7 | 28 | 9·244656 | 14 165 | 10·755344 | 9·251461 | 14 170 | 10·748539 | 10·006805 | 14 5 | 9·993195 | 32 | 53 |
| 30 | 30 | 9·245010 | 15 177 | 10·754990 | 9·251826 | 15 183 | 10·748174 | 10·006817 | 15 6 | 9·993183 | 30 | 30 |
| 8 | 32 | 9·245363 | 16 189 | 10·754637 | 9·252191 | 16 195 | 10·747809 | 10·006828 | 16 6 | 9·993172 | 28 | 52 |
| 30 | 34 | 9·245717 | 17 200 | 10·754283 | 9·252556 | 17 207 | 10·747444 | 10·006839 | 17 6 | 9·993161 | 26 | 30 |
| 9 | 36 | 9·246069 | 18 212 | 10·753931 | 9·252920 | 18 219 | 10·747080 | 10·006851 | 18 7 | 9·993149 | 24 | 51 |
| 30 | 38 | 9·246422 | 19 224 | 10·753578 | 9·253284 | 19 231 | 10·746716 | 10·006862 | 19 7 | 9·993138 | 22 | 30 |
| 10 | 40 | 9·246775 | 20 236 | 10·753225 | 9·253648 | 20 243 | 10·746352 | 10·006873 | 20 8 | 9·993127 | 20 | 50 |
| 30 | 42 | 9·247127 | 21 248 | 10·752873 | 9·254011 | 21 256 | 10·745989 | 10·006885 | 21 8 | 9·993115 | 18 | 30 |
| 11 | 44 | 9·247478 | 22 259 | 10·752522 | 9·254374 | 22 268 | 10·745626 | 10·006896 | 22 8 | 9·993104 | 16 | 49 |
| 30 | 46 | 9·247830 | 23 271 | 10·752170 | 9·254737 | 23 280 | 10·745263 | 10·006907 | 23 9 | 9·993093 | 14 | 30 |
| 12 | 48 | 9·248181 | 24 283 | 10·751819 | 9·255100 | 24 292 | 10·744900 | 10·006919 | 24 9 | 9·993081 | 12 | 48 |
| 30 | 50 | 9·248532 | 25 295 | 10·751468 | 9·255462 | 25 304 | 10·744538 | 10·006930 | 25 9 | 9·993070 | 10 | 30 |
| 13 | 52 | 9·248883 | 26 307 | 10·751117 | 9·255824 | 26 316 | 10·744176 | 10·006941 | 26 10 | 9·993059 | 8 | 47 |
| 30 | 54 | 9·249233 | 27 318 | 10·750767 | 9·256186 | 27 329 | 10·743814 | 10·006953 | 27 10 | 9·993047 | 6 | 30 |
| 14 | 56 | 9·249583 | 28 330 | 10·750417 | 9·256547 | 28 341 | 10·743453 | 10·006964 | 28 11 | 9·993036 | 4 | 46 |
| 30 | 58 | 9·249933 | 29 342 | 10·750067 | 9·256908 | 29 353 | 10·743092 | 10·006976 | 29 11 | 9·993024 | 2 | 30 |
| 15 | **41** | 9·250282 | 30 354 | 10·749718 | 9·257269 | 30 365 | 10·742731 | 10·006987 | 30 11 | 9·993013 | **19** | 45 |
| 30 | 2 | 9·250631 | 1″ 11 | 10·749369 | 9·257630 | 1 12 | 10·742370 | 10·006998 | 1 0 | 9·993002 | 58 | 30 |
| 16 | 4 | 9·250980 | 2 23 | 10·749020 | 9·257990 | 2 24 | 10·742010 | 10·007010 | 2 1 | 9·992990 | 56 | 44 |
| 30 | 6 | 9·251329 | 3 34 | 10·748671 | 9·258350 | 3 36 | 10·741650 | 10·007021 | 3 1 | 9·992979 | 54 | 30 |
| 17 | 8 | 9·251677 | 4 46 | 10·748323 | 9·258710 | 4 48 | 10·741290 | 10·007033 | 4 2 | 9·992967 | 52 | 43 |
| 30 | 10 | 9·252025 | 5 57 | 10·747975 | 9·259069 | 5 59 | 10·740931 | 10·007044 | 5 2 | 9·992956 | 50 | 30 |
| 18 | 12 | 9·252373 | 6 69 | 10·747627 | 9·259429 | 6 71 | 10·740571 | 10·007056 | 6 2 | 9·992944 | 48 | 42 |
| 30 | 14 | 9·252720 | 7 80 | 10·747280 | 9·259787 | 7 83 | 10·740213 | 10·007067 | 7 3 | 9·992933 | 46 | 30 |
| 19 | 16 | 9·253067 | 8 92 | 10·746933 | 9·260146 | 8 95 | 10 739854 | 10·007079 | 8 3 | 9·992921 | 44 | 41 |
| 30 | 18 | 9·253414 | 9 103 | 10·746586 | 9·260504 | 9 107 | 10·739496 | 10·007090 | 9 3 | 9·992910 | 42 | 30 |
| 20 | 20 | 9·253761 | 10 115 | 10·746239 | 9·260863 | 10 119 | 10·739137 | 10·007102 | 10 4 | 9·992898 | 40 | 40 |
| 30 | 22 | 9·254107 | 11 126 | 10·745893 | 9·261220 | 11 131 | 10·738780 | 10·007113 | 11 4 | 9·992887 | 38 | 30 |
| 21 | 24 | 9·254453 | 12 138 | 10·745547 | 9·261578 | 12 143 | 10·738422 | 10·007125 | 12 5 | 9·992875 | 36 | 39 |
| 30 | 26 | 9·254799 | 13 149 | 10·745201 | 9·261935 | 13 155 | 10·738065 | 10·007136 | 13 5 | 9·992864 | 34 | 30 |
| 22 | 28 | 9·255144 | 14 161 | 10·744856 | 9·262292 | 14 167 | 10·737708 | 10·007148 | 14 5 | 9·992852 | 32 | 38 |
| 30 | 30 | 9·255490 | 15 172 | 10·744510 | 9·262649 | 15 178 | 10·737351 | 10·007159 | 15 6 | 9·992841 | 30 | 30 |
| 23 | 32 | 9·255834 | 16 184 | 10·744166 | 9·263005 | 16 190 | 10·736995 | 10·007171 | 16 6 | 9·992829 | 28 | 37 |
| 30 | 34 | 9·256179 | 17 195 | 10·743821 | 9·263361 | 17 202 | 10·736639 | 10·007182 | 17 6 | 9·992818 | 26 | 30 |
| 24 | 36 | 9·256523 | 18 207 | 10·743477 | 9·263717 | 18 214 | 10·736283 | 10·007194 | 18 7 | 9·992806 | 24 | 36 |
| 30 | 38 | 9·256867 | 19 218 | 10·743133 | 9·264073 | 19 226 | 10·735927 | 10·007206 | 19 7 | 9·992794 | 22 | 30 |
| 25 | 40 | 9·257211 | 20 230 | 10·742789 | 9·264428 | 20 238 | 10·735572 | 10·007217 | 20 8 | 9·992783 | 20 | 35 |
| 30 | 42 | 9·257554 | 21 241 | 10·742446 | 9·264783 | 21 250 | 10·735217 | 10·007229 | 21 8 | 9·992771 | 18 | 30 |
| 26 | 44 | 9·257898 | 22 253 | 10·742102 | 9·265138 | 22 262 | 10·734862 | 10·007241 | 22 8 | 9·992759 | 16 | 34 |
| 30 | 46 | 9·258241 | 23 264 | 10·741759 | 9·265493 | 23 274 | 10·734507 | 10·007252 | 23 9 | 9·992748 | 14 | 30 |
| 27 | 48 | 9·258583 | 24 276 | 10·741417 | 9·265847 | 24 285 | 10·734153 | 10·007265 | 24 9 | 9·992736 | 12 | 33 |
| 30 | 50 | 9·258926 | 25 287 | 10·741074 | 9·266201 | 25 297 | 10·733799 | 10·007276 | 25 10 | 9·992724 | 10 | 30 |
| 28 | 52 | 9·259268 | 26 299 | 10·740732 | 9·266555 | 26 309 | 10·733445 | 10·007287 | 26 10 | 9·992713 | 8 | 32 |
| 30 | 54 | 9·259609 | 27 310 | 10·740391 | 9·266908 | 27 321 | 10·733092 | 10·007299 | 27 10 | 9·992701 | 6 | 30 |
| 29 | 56 | 9·259951 | 28 322 | 10·740049 | 9·267261 | 28 333 | 10·732739 | 10·007310 | 28 11 | 9·992690 | 4 | 31 |
| 30 | 58 | 9·260292 | 29 333 | 10·739708 | 9·267614 | 29 345 | 10·732386 | 10·007322 | 29 11 | 9·992678 | 2 | 30 |
| 30 | **42** | 9·260633 | 30 345 | 10·739367 | 9·267967 | 30 357 | 10·732033 | 10·007334 | 30 12 | 9·992666 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

79° — 5ʰ 18ᵐ

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0ʰ 42ᵐ — 10°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·260633 | | 10·739367 | 9·267967 | | 10·732033 | 10·007334 | | 9·992666 | **18** | 30 |
| 30 | 2 | 9·260974 | 1″ 11 | 10·739026 | 9·268319 | 1″ 12 | 10·731681 | 10·007346 | 1″ 0 | 9·992654 | 58 | 30 |
| 31 | 4 | 9·261314 | 2 22 | 10·738686 | 9·268671 | 2 23 | 10·731329 | 10·007357 | 2 1 | 9·992643 | 56 | 29 |
| 30 | 6 | 9·261654 | 3 34 | 10·738346 | 9·269023 | 3 35 | 10·730977 | 10·007369 | 3 1 | 9·992631 | 54 | 30 |
| 32 | 8 | 9·261994 | 4 45 | 10·738006 | 9·269375 | 4 46 | 10·730625 | 10·007381 | 4 2 | 9·992619 | 52 | 28 |
| 30 | 10 | 9·262334 | 5 56 | 10·737666 | 9·269726 | 5 58 | 10·730274 | 10·007393 | 5 2 | 9·992607 | 50 | 30 |
| 33 | 12 | 9·262673 | 6 67 | 10·737327 | 9·270077 | 6 70 | 10·729923 | 10·007404 | 6 2 | 9·992596 | 48 | 27 |
| 30 | 14 | 9·263012 | 7 78 | 10·736988 | 9·270428 | 7 81 | 10·729572 | 10·007416 | 7 3 | 9·992584 | 46 | 30 |
| 34 | 16 | 9·263351 | 8 90 | 10·736649 | 9·270779 | 8 93 | 10·729221 | 10·007428 | 8 3 | 9·992572 | 44 | 26 |
| 30 | 18 | 9·263689 | 9 101 | 10·736311 | 9·271129 | 9 105 | 10·728871 | 10·007440 | 9 4 | 9·992560 | 42 | 30 |
| 35 | 20 | 9·264027 | 10 112 | 10·735973 | 9·271479 | 10 116 | 10·728521 | 10·007451 | 10 4 | 9·992549 | 40 | 25 |
| 30 | 22 | 9·264365 | 11 123 | 10·735635 | 9·271829 | 11 128 | 10·728171 | 10·007463 | 11 4 | 9·992537 | 38 | 30 |
| 36 | 24 | 9·264703 | 12 135 | 10·735297 | 9·272178 | 12 139 | 10·727822 | 10·007475 | 12 5 | 9·992525 | 36 | 24 |
| 30 | 26 | 9·265040 | 13 146 | 10·734960 | 9·272527 | 13 151 | 10·727473 | 10·007487 | 13 5 | 9·992513 | 34 | 30 |
| 37 | 28 | 9·265377 | 14 157 | 10·734623 | 9·272876 | 14 162 | 10·727124 | 10·007499 | 14 6 | 9·992501 | 32 | 23 |
| 30 | 30 | 9·265714 | 15 168 | 10·734286 | 9·273225 | 15 174 | 10·726775 | 10·007511 | 15 6 | 9·992489 | 30 | 30 |
| 38 | 32 | 9·266051 | 16 179 | 10·733949 | 9·273573 | 16 186 | 10·726427 | 10·007522 | 16 6 | 9·992478 | 28 | 22 |
| 30 | 34 | 9·266387 | 17 191 | 10·733613 | 9·273921 | 17 197 | 10·726079 | 10·007534 | 17 7 | 9·992466 | 26 | 30 |
| 39 | 36 | 9·266723 | 18 202 | 10·733277 | 9·274269 | 18 209 | 10·725731 | 10·007546 | 18 7 | 9·992454 | 24 | 21 |
| 30 | 38 | 9·267059 | 19 213 | 10·732941 | 9·274617 | 19 221 | 10·725383 | 10·007558 | 19 7 | 9·992442 | 22 | 30 |
| 40 | 40 | 9·267395 | 20 224 | 10·732605 | 9·274964 | 20 232 | 10·725036 | 10·007570 | 20 8 | 9·992430 | 20 | 20 |
| 30 | 42 | 9·267730 | 21 236 | 10·732270 | 9·275312 | 21 244 | 10·724688 | 10·007582 | 21 8 | 9·992418 | 18 | 30 |
| 41 | 44 | 9·268065 | 22 247 | 10·731935 | 9·275658 | 22 256 | 10·724342 | 10·007594 | 22 9 | 9·992406 | 16 | 19 |
| 30 | 46 | 9·268399 | 23 258 | 10·731601 | 9·276005 | 23 267 | 10·723995 | 10·007606 | 23 9 | 9·992394 | 14 | 30 |
| 42 | 48 | 9·268734 | 24 269 | 10·731266 | 9·276351 | 24 279 | 10·723649 | 10·007618 | 24 9 | 9·992382 | 12 | 18 |
| 30 | 50 | 9·269068 | 25 280 | 10·730932 | 9·276698 | 25 290 | 10·723302 | 10·007630 | 25 10 | 9·992370 | 10 | 30 |
| 43 | 52 | 9·269402 | 26 292 | 10·730598 | 9·277043 | 26 302 | 10·722957 | 10·007641 | 26 10 | 9·992359 | 8 | 17 |
| 30 | 54 | 9·269736 | 27 303 | 10·730264 | 9·277389 | 27 314 | 10·722611 | 10·007653 | 27 11 | 9·992347 | 6 | 30 |
| 44 | 56 | 9·270069 | 28 315 | 10·729931 | 9·277734 | 28 325 | 10·722266 | 10·007665 | 28 11 | 9·992335 | 4 | 16 |
| 30 | 58 | 9·270402 | 29 326 | 10·729598 | 9·278079 | 29 337 | 10·721921 | 10·007677 | 29 11 | 9·992323 | 2 | 30 |
| 45 | **43** | 9·270735 | 30 337 | 10·729265 | 9·278424 | 30 349 | 10·721576 | 10·007689 | 30 12 | 9·992311 | **17** | 15 |
| 30 | 2 | 9·271067 | 1 11 | 10·728933 | 9·278769 | 1 11 | 10·721231 | 10·007701 | 1 0 | 9·992299 | 58 | 30 |
| 46 | 4 | 9·271400 | 2 22 | 10·728600 | 9·279113 | 2 23 | 10·720887 | 10·007713 | 2 1 | 9·992287 | 56 | 14 |
| 30 | 6 | 9·271732 | 3 33 | 10·728268 | 9·279457 | 3 34 | 10·720543 | 10·007725 | 3 1 | 9·992275 | 54 | 30 |
| 47 | 8 | 9·272064 | 4 44 | 10·727936 | 9·279801 | 4 45 | 10·720199 | 10·007737 | 4 2 | 9·992263 | 52 | 13 |
| 30 | 10 | 9·272395 | 5 55 | 10·727605 | 9·280144 | 5 57 | 10·719856 | 10·007749 | 5 2 | 9·992251 | 50 | 30 |
| 48 | 12 | 9·272726 | 6 66 | 10·727274 | 9·280488 | 6 68 | 10·719512 | 10·007761 | 6 2 | 9·992239 | 48 | 12 |
| 30 | 14 | 9·273057 | 7 77 | 10·726943 | 9·280831 | 7 79 | 10·719169 | 10·007774 | 7 3 | 9·992226 | 46 | 30 |
| 49 | 16 | 9·273388 | 8 88 | 10·726612 | 9·281174 | 8 91 | 10·718826 | 10·007786 | 8 3 | 9·992214 | 44 | 11 |
| 30 | 18 | 9·273718 | 9 99 | 10·726282 | 9·281516 | 9 102 | 10·718484 | 10·007798 | 9 4 | 9·992202 | 42 | 30 |
| 50 | 20 | 9·274049 | 10 110 | 10·725951 | 9·281858 | 10 114 | 10·718142 | 10·007810 | 10 4 | 9·992190 | 40 | 10 |
| 30 | 22 | 9·274379 | 11 121 | 10·725621 | 9·282201 | 11 125 | 10·717799 | 10·007822 | 11 4 | 9·992178 | 38 | 30 |
| 51 | 24 | 9·274708 | 12 132 | 10·725292 | 9·282542 | 12 136 | 10·717458 | 10·007834 | 12 5 | 9·992166 | 36 | 9 |
| 30 | 26 | 9·275038 | 13 142 | 10·724962 | 9·282884 | 13 148 | 10·717116 | 10·007846 | 13 5 | 9·992154 | 34 | 30 |
| 52 | 28 | 9·275367 | 14 153 | 10·724633 | 9·283225 | 14 159 | 10·716775 | 10·007858 | 14 6 | 9·992142 | 32 | 8 |
| 30 | 30 | 9·275696 | 15 164 | 10·724304 | 9·283566 | 15 170 | 10·716434 | 10·007870 | 15 6 | 9·992130 | 30 | 30 |
| 53 | 32 | 9·276025 | 16 175 | 10·723975 | 9·283907 | 16 182 | 10·716093 | 10·007882 | 16 6 | 9·992118 | 28 | 7 |
| 30 | 34 | 9·276353 | 17 186 | 10·723647 | 9·284248 | 17 193 | 10·715752 | 10·007895 | 17 7 | 9·992105 | 26 | 30 |
| 54 | 36 | 9·276681 | 18 197 | 10·723319 | 9·284588 | 18 205 | 10·715412 | 10·007907 | 18 7 | 9·992093 | 24 | 6 |
| 30 | 38 | 9·277009 | 19 208 | 10·722991 | 9·284928 | 19 216 | 10·715072 | 10·007919 | 19 8 | 9·992081 | 22 | 30 |
| 55 | 40 | 9·277337 | 20 219 | 10·722663 | 9·285268 | 20 227 | 10·714732 | 10·007931 | 20 8 | 9·992069 | 20 | 5 |
| 30 | 42 | 9·277664 | 21 230 | 10·722336 | 9·285607 | 21 239 | 10·714393 | 10·007943 | 21 8 | 9·992057 | 18 | 30 |
| 56 | 44 | 9·277991 | 22 241 | 10·722009 | 9·285947 | 22 250 | 10·714053 | 10·007956 | 22 9 | 9·992044 | 16 | 4 |
| 30 | 46 | 9·278318 | 23 252 | 10·721682 | 9·286286 | 23 261 | 10·713714 | 10·007968 | 23 9 | 9·992032 | 14 | 30 |
| 57 | 48 | 9·278645 | 24 263 | 10·721355 | 9·286624 | 24 273 | 10·713376 | 10·007980 | 24 10 | 9·992020 | 12 | 3 |
| 30 | 50 | 9·278971 | 25 274 | 10·721029 | 9·286963 | 25 284 | 10·713037 | 10·007992 | 25 10 | 9·992008 | 10 | 30 |
| 58 | 52 | 9·279297 | 26 285 | 10·720703 | 9·287301 | 26 295 | 10·712699 | 10·008004 | 26 10 | 9·991996 | 8 | 2 |
| 30 | 54 | 9·279623 | 27 296 | 10·720377 | 9·287639 | 27 307 | 10·712361 | 10·008017 | 27 11 | 9·991983 | 6 | 30 |
| 59 | 56 | 9·279948 | 28 307 | 10·720052 | 9·287977 | 28 318 | 10·712023 | 10·008029 | 28 11 | 9·991971 | 4 | 1 |
| 30 | 58 | 9·280274 | 29 318 | 10·719726 | 9·288315 | 29 330 | 10·711685 | 10·008041 | 29 12 | 9·991959 | 2 | 30 |
| 60 | **44** | 9·280599 | 30 329 | 10·719401 | 9·288652 | 30 341 | 10·711348 | 10·008053 | 30 12 | 9·991947 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

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TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

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| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·280599 | | 10·719401 | 9·288652 | | 10·711348 | 10·008053 | | 9·991947 | 16 | 60 |
| 30 | 2 | 9·280924 | 1″ 11 | 10·719076 | 9·288989 | 1″ 11 | 10·711011 | 10·008066 | 1″ 0 | 9·991934 | 58 | 30 |
| 1 | 4 | 9·281248 | 2 21 | 10·718752 | 9·289326 | 2 22 | 10·710674 | 10·008078 | 2 1 | 9·991922 | 56 | 59 |
| 30 | 6 | 9·281573 | 3 32 | 10·718427 | 9·289663 | 3 33 | 10·710337 | 10·008090 | 3 1 | 9·991910 | 54 | 30 |
| 2 | 8 | 9·281897 | 4 43 | 10·718103 | 9·289999 | 4 44 | 10·710001 | 10·008103 | 4 2 | 9·991897 | 52 | 58 |
| 30 | 10 | 9·282220 | 5 53 | 10·717780 | 9·290335 | 5 56 | 10·709665 | 10·008115 | 5 2 | 9·991885 | 50 | 30 |
| 3 | 12 | 9·282544 | 6 64 | 10·717456 | 9·290671 | 6 67 | 10·709329 | 10·008127 | 6 2 | 9·991873 | 48 | 57 |
| 30 | 14 | 9·282867 | 7 75 | 10·717133 | 9·291007 | 7 78 | 10·708993 | 10·008140 | 7 3 | 9·991860 | 46 | 30 |
| 4 | 16 | 9·283190 | 8 86 | 10·716810 | 9·291342 | 8 89 | 10·708658 | 10·008152 | 8 3 | 9·991848 | 44 | 56 |
| 30 | 18 | 9·283513 | 9 96 | 10·716487 | 9·291678 | 9 100 | 10·708322 | 10·008164 | 9 4 | 9·991836 | 42 | 30 |
| 5 | 20 | 9·283836 | 10 107 | 10·716164 | 9·292013 | 10 111 | 10·707987 | 10·008177 | 10 4 | 9·991823 | 40 | 55 |
| 30 | 22 | 9·284158 | 11 118 | 10·715842 | 9·292347 | 11 122 | 10·707653 | 10·008189 | 11 5 | 9·991811 | 38 | 30 |
| 6 | 24 | 9·284480 | 12 128 | 10·715520 | 9·292682 | 12 133 | 10·707318 | 10·008201 | 12 5 | 9·991799 | 36 | 54 |
| 30 | 26 | 9·284802 | 13 139 | 10·715198 | 9·293016 | 13 145 | 10·706984 | 10·008214 | 13 5 | 9·991786 | 34 | 30 |
| 7 | 28 | 9·285124 | 14 150 | 10·714876 | 9·293350 | 14 156 | 10·706650 | 10·008226 | 14 6 | 9·991774 | 32 | 53 |
| 30 | 30 | 9·285445 | 15 160 | 10·714555 | 9·293684 | 15 167 | 10·706316 | 10·008239 | 15 6 | 9·991761 | 30 | 30 |
| 8 | 32 | 9·285766 | 16 171 | 10·714234 | 9·294017 | 16 178 | 10·705983 | 10·008251 | 16 7 | 9·991749 | 28 | 52 |
| 30 | 34 | 9·286087 | 17 182 | 10·713913 | 9·294351 | 17 189 | 10·705649 | 10·008264 | 17 7 | 9·991736 | 26 | 30 |
| 9 | 36 | 9·286408 | 18 193 | 10·713592 | 9·294684 | 18 200 | 10·705316 | 10·008276 | 18 7 | 9·991724 | 24 | 51 |
| 30 | 38 | 9·286728 | 19 203 | 10·713272 | 9·295016 | 19 211 | 10·704984 | 10·008288 | 19 8 | 9·991712 | 22 | 30 |
| 10 | 40 | 9·287048 | 20 214 | 10·712952 | 9·295349 | 20 222 | 10·704651 | 10·008301 | 20 8 | 9·991699 | 20 | 50 |
| 30 | 42 | 9·287368 | 21 225 | 10·712632 | 9·295681 | 21 233 | 10·704319 | 10·008313 | 21 9 | 9·991687 | 18 | 30 |
| 11 | 44 | 9·287688 | 22 235 | 10·712312 | 9·296013 | 22 245 | 10·703987 | 10·008326 | 22 9 | 9·991674 | 16 | 49 |
| 30 | 46 | 9·288007 | 23 246 | 10·711993 | 9·296345 | 23 256 | 10·703655 | 10·008338 | 23 10 | 9·991662 | 14 | 30 |
| 12 | 48 | 9·288326 | 24 257 | 10·711674 | 9·296677 | 24 267 | 10·703323 | 10·008351 | 24 10 | 9·991649 | 12 | 48 |
| 30 | 50 | 9·288645 | 25 267 | 10·711355 | 9·297008 | 25 278 | 10·702992 | 10·008363 | 25 10 | 9·991637 | 10 | 30 |
| 13 | 52 | 9·288964 | 26 278 | 10·711036 | 9·297339 | 26 289 | 10·702661 | 10·008376 | 26 11 | 9·991624 | 8 | 47 |
| 30 | 54 | 9·289282 | 27 289 | 10·710718 | 9·297670 | 27 300 | 10·702330 | 10·008388 | 27 11 | 9·991612 | 6 | 30 |
| 14 | 56 | 9·289600 | 28 300 | 10·710400 | 9·298001 | 28 311 | 10·701999 | 10·008401 | 28 12 | 9·991599 | 4 | 46 |
| 30 | 58 | 9·289918 | 29 310 | 10·710082 | 9·298332 | 29 322 | 10·701668 | 10·008414 | 29 12 | 9·991586 | 2 | 30 |
| 15 | 45 | 9·290236 | 30 321 | 10·709764 | 9·298662 | 30 334 | 10·701338 | 10·008426 | 30 12 | 9·991574 | 15 | 45 |
| 30 | 2 | 9·290553 | 1 10 | 10·709447 | 9·298992 | 1 11 | 10·701008 | 10·008439 | 1 0 | 9·991561 | 58 | 30 |
| 16 | 4 | 9·290870 | 2 21 | 10·709130 | 9·299322 | 2 22 | 10·700678 | 10·008451 | 2 1 | 9·991549 | 56 | 44 |
| 30 | 6 | 9·291187 | 3 31 | 10·708813 | 9·299651 | 3 33 | 10·700349 | 10·008464 | 3 1 | 9·991536 | 54 | 30 |
| 17 | 8 | 9·291504 | 4 42 | 10·708496 | 9·299980 | 4 44 | 10·700020 | 10·008476 | 4 2 | 9·991524 | 52 | 43 |
| 30 | 10 | 9·291820 | 5 52 | 10·708180 | 9·300309 | 5 54 | 10·699691 | 10·008489 | 5 2 | 9·991511 | 50 | 30 |
| 18 | 12 | 9·292137 | 6 63 | 10·707863 | 9·300638 | 6 65 | 10·699362 | 10·008502 | 6 3 | 9·991498 | 48 | 42 |
| 30 | 14 | 9·292453 | 7 73 | 10·707547 | 9·300967 | 7 76 | 10·699033 | 10·008514 | 7 3 | 9·991486 | 46 | 30 |
| 19 | 16 | 9·292768 | 8 84 | 10·707232 | 9·301295 | 8 87 | 10·698705 | 10·008527 | 8 3 | 9·991473 | 44 | 41 |
| 30 | 18 | 9·293084 | 9 94 | 10·706916 | 9·301624 | 9 98 | 10·698376 | 10·008540 | 9 4 | 9·991460 | 42 | 30 |
| 20 | 20 | 9·293399 | 10 105 | 10·706601 | 9·301951 | 10 109 | 10·698049 | 10·008552 | 10 4 | 9·991448 | 40 | 40 |
| 30 | 22 | 9·293714 | 11 115 | 10·706286 | 9·302279 | 11 120 | 10·697721 | 10·008565 | 11 5 | 9·991435 | 38 | 30 |
| 21 | 24 | 9·294029 | 12 126 | 10·705971 | 9·302607 | 12 131 | 10·697393 | 10·008578 | 12 5 | 9·991422 | 36 | 39 |
| 30 | 26 | 9·294344 | 13 136 | 10·705656 | 9·302934 | 13 142 | 10·697066 | 10·008590 | 13 6 | 9·991410 | 34 | 30 |
| 22 | 28 | 9·294658 | 14 147 | 10·705342 | 9·303261 | 14 153 | 10·696739 | 10·008603 | 14 6 | 9·991397 | 32 | 38 |
| 30 | 30 | 9·294972 | 15 157 | 10·705028 | 9·303588 | 15 163 | 10·696412 | 10·008616 | 15 6 | 9·991384 | 30 | 30 |
| 23 | 32 | 9·295286 | 16 168 | 10·704714 | 9·303914 | 16 174 | 10·696086 | 10·008628 | 16 7 | 9·991372 | 28 | 37 |
| 30 | 34 | 9·295600 | 17 178 | 10·704400 | 9·304241 | 17 185 | 10·695759 | 10·008641 | 17 7 | 9·991359 | 26 | 30 |
| 24 | 36 | 9·295913 | 18 188 | 10·704087 | 9·304567 | 18 196 | 10·695433 | 10·008654 | 18 8 | 9·991346 | 24 | 36 |
| 30 | 38 | 9·296226 | 19 199 | 10·703774 | 9·304893 | 19 207 | 10·695107 | 10·008667 | 19 8 | 9·991333 | 22 | 30 |
| 25 | 40 | 9·296539 | 20 209 | 10·703461 | 9·305218 | 20 218 | 10·694782 | 10·008679 | 20 8 | 9·991321 | 20 | 35 |
| 30 | 42 | 9·296852 | 21 220 | 10·703148 | 9·305544 | 21 229 | 10·694456 | 10·008692 | 21 9 | 9·991308 | 18 | 30 |
| 26 | 44 | 9·297164 | 22 230 | 10·702836 | 9·305869 | 22 240 | 10·694131 | 10·008705 | 22 9 | 9·991295 | 16 | 34 |
| 30 | 46 | 9·297476 | 23 241 | 10·702524 | 9·306194 | 23 251 | 10·693806 | 10·008718 | 23 10 | 9·991282 | 14 | 30 |
| 27 | 48 | 9·297788 | 24 251 | 10·702212 | 9·306519 | 24 262 | 10·693481 | 10·008730 | 24 10 | 9·991270 | 12 | 33 |
| 30 | 50 | 9·298100 | 25 262 | 10·701900 | 9·306843 | 25 272 | 10·693157 | 10·008743 | 25 11 | 9·991257 | 10 | 30 |
| 28 | 52 | 9·298412 | 26 272 | 10·701588 | 9·307168 | 26 283 | 10·692832 | 10·008756 | 26 11 | 9·991244 | 8 | 32 |
| 30 | 54 | 9·298723 | 27 283 | 10·701277 | 9·307492 | 27 294 | 10·692508 | 10·008769 | 27 11 | 9·991231 | 6 | 30 |
| 29 | 56 | 9·299034 | 28 293 | 10·700966 | 9·307816 | 28 305 | 10·692184 | 10·008782 | 28 12 | 9·991218 | 4 | 31 |
| 30 | 58 | 9·299345 | 29 304 | 10·700655 | 9·308139 | 29 316 | 10·691861 | 10·008794 | 29 12 | 9·991206 | 2 | 30 |
| 30 | 46 | 9·299655 | 30 314 | 10·700345 | 9·308463 | 30 327 | 10·691537 | 10·008807 | 30 13 | 9·991193 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

78° | 5h 14m

TABLE XXVI.—(*continued*).

LOG. SINES. COSINES, &c.

0h 46m — 11°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·299655 | | 10·700345 | 9·308463 | | 10·691537 | 10·008807 | | 9·991193 | 14 | 30 |
| 30 | 2 | 9·299966 | 1″ 10 | 10·700034 | 9·308786 | 1″ 11 | 10·691214 | 10·008820 | 1″ 0 | 9·991180 | 58 | 30 |
| 31 | 4 | 9·300276 | 2 21 | 10·699724 | 9·309109 | 2 21 | 10·690891 | 10·008833 | 2 1 | 9·991167 | 56 | 29 |
| 30 | 6 | 9·300586 | 3 31 | 10·699414 | 9·309432 | 3 32 | 10·690568 | 10·008846 | 3 1 | 9·991154 | 54 | 30 |
| 32 | 8 | 9·300895 | 4 41 | 10·699105 | 9·309754 | 4 43 | 10·690246 | 10·008859 | 4 2 | 9·991141 | 52 | 28 |
| 30 | 10 | 9·301205 | 5 51 | 10·698795 | 9·310076 | 5 53 | 10·689924 | 10·008872 | 5 2 | 9·991128 | 50 | 30 |
| 33 | 12 | 9·301514 | 6 61 | 10·698486 | 9·310399 | 6 64 | 10·689601 | 10·008885 | 6 3 | 9·991115 | 48 | 27 |
| 30 | 14 | 9·301823 | 7 71 | 10·698177 | 9·310720 | 7 75 | 10·689280 | 10·008897 | 7 3 | 9·991103 | 46 | 30 |
| 34 | 16 | 9·302132 | 8 82 | 10·697868 | 9·311042 | 8 85 | 10·688958 | 10·008910 | 8 3 | 9·991090 | 44 | 26 |
| 30 | 18 | 9·302440 | 9 92 | 10·697560 | 9·311364 | 9 96 | 10·688636 | 10·008923 | 9 4 | 9·991077 | 42 | 30 |
| 35 | 20 | 9·302748 | 10 102 | 10·697252 | 9·311685 | 10 107 | 10·688315 | 10·008936 | 10 4 | 9·991064 | 40 | 25 |
| 30 | 22 | 9·303057 | 11 113 | 10·696943 | 9·312006 | 11 117 | 10·687994 | 10·008949 | 11 5 | 9·991051 | 38 | 30 |
| 36 | 24 | 9·303364 | 12 123 | 10·696636 | 9·312327 | 12 128 | 10·687673 | 10·008962 | 12 5 | 9·991038 | 36 | 24 |
| 30 | 26 | 9·303672 | 13 133 | 10·696328 | 9·312647 | 13 139 | 10·687353 | 10·008975 | 13 6 | 9·991025 | 34 | 30 |
| 37 | 28 | 9·303979 | 14 143 | 10·696021 | 9·312968 | 14 149 | 10·687032 | 10·008988 | 14 6 | 9·991012 | 32 | 23 |
| 30 | 30 | 9·304287 | 15 153 | 10·695713 | 9·313288 | 15 160 | 10·686712 | 10·009001 | 15 6 | 9·990999 | 30 | 30 |
| 38 | 32 | 9·304593 | 16 164 | 10·695407 | 9·313608 | 16 171 | 10·686392 | 10·009014 | 16 7 | 9·990986 | 28 | 22 |
| 30 | 34 | 9·304900 | 17 174 | 10·695100 | 9·313927 | 17 181 | 10·686073 | 10·009027 | 17 7 | 9·990973 | 26 | 30 |
| 39 | 36 | 9·305207 | 18 184 | 10·694793 | 9·314247 | 18 192 | 10·685753 | 10·009040 | 18 8 | 9·990960 | 24 | 21 |
| 30 | 38 | 9·305513 | 19 194 | 10·694487 | 9·314566 | 19 203 | 10·685434 | 10·009053 | 19 8 | 9·990947 | 22 | 30 |
| 40 | 40 | 9·305819 | 20 205 | 10·694181 | 9·314885 | 20 213 | 10·685115 | 10·009066 | 20 9 | 9·990934 | 20 | 20 |
| 30 | 42 | 9·306125 | 21 215 | 10·693875 | 9·315204 | 21 224 | 10·684796 | 10·009079 | 21 9 | 9·990921 | 18 | 30 |
| 41 | 44 | 9·306430 | 22 225 | 10·693570 | 9·315523 | 22 235 | 10·684477 | 10·009092 | 22 10 | 9·990908 | 16 | 19 |
| 30 | 46 | 9·306736 | 23 235 | 10·693264 | 9·315841 | 23 245 | 10·684159 | 10·009105 | 23 10 | 9·990895 | 14 | 30 |
| 42 | 48 | 9·307041 | 24 245 | 10·692959 | 9·316159 | 24 256 | 10·683841 | 10·009118 | 24 10 | 9·990882 | 12 | 18 |
| 30 | 50 | 9·307346 | 25 256 | 10·692654 | 9·316477 | 25 267 | 10·683523 | 10·009132 | 25 11 | 9·990868 | 10 | 30 |
| 43 | 52 | 9·307650 | 26 266 | 10·692350 | 9·316795 | 26 277 | 10·683205 | 10·009145 | 26 11 | 9·990855 | 8 | 17 |
| 30 | 54 | 9·307955 | 27 276 | 10·692045 | 9·317113 | 27 288 | 10·682887 | 10·009158 | 27 12 | 9·990842 | 6 | 30 |
| 44 | 56 | 9·308259 | 28 286 | 10·691741 | 9·317430 | 28 299 | 10·682570 | 10·009171 | 28 12 | 9·990829 | 4 | 16 |
| 30 | 58 | 9·308563 | 29 297 | 10·691437 | 9·317747 | 29 309 | 10·682253 | 10·009184 | 29 13 | 9·990816 | 2 | 30 |
| 45 | 47 | 9·308867 | 30 307 | 10·691133 | 9·318064 | 30 320 | 10·681936 | 10·009197 | 30 13 | 9·990803 | 13 | 15 |
| 30 | 2 | 9·309170 | 1 10 | 10·690830 | 9·318381 | 1 10 | 10·681619 | 10·009210 | 1 0 | 9·990790 | 58 | 30 |
| 46 | 4 | 9·309474 | 2 20 | 10·690526 | 9·318697 | 2 21 | 10·681303 | 10·009223 | 2 1 | 9·990777 | 56 | 14 |
| 30 | 6 | 9·309777 | 3 30 | 10·690223 | 9·319013 | 3 31 | 10·680987 | 10·009237 | 3 1 | 9·990763 | 54 | 30 |
| 47 | 8 | 9·310080 | 4 40 | 10·689920 | 9·319330 | 4 42 | 10·680670 | 10·009250 | 4 2 | 9·990750 | 52 | 13 |
| 30 | 10 | 9·310382 | 5 50 | 10·689618 | 9·319645 | 5 52 | 10·680355 | 10·009263 | 5 2 | 9·990737 | 50 | 30 |
| 48 | 12 | 9·310685 | 6 60 | 10·689315 | 9·319961 | 6 63 | 10·680039 | 10·009276 | 6 3 | 9·990724 | 48 | 12 |
| 30 | 14 | 9·310987 | 7 70 | 10·689013 | 9·320277 | 7 73 | 10·679723 | 10·009289 | 7 3 | 9·990711 | 46 | 30 |
| 49 | 16 | 9·311289 | 8 80 | 10·688711 | 9·320592 | 8 84 | 10·679408 | 10·009303 | 8 4 | 9·990697 | 44 | 11 |
| 30 | 18 | 9·311591 | 9 90 | 10·688409 | 9·320907 | 9 94 | 10·679093 | 10·009316 | 9 4 | 9·990684 | 42 | 30 |
| 50 | 20 | 9·311893 | 10 100 | 10·688107 | 9·321222 | 10 104 | 10·678778 | 10·009329 | 10 4 | 9·990671 | 40 | 10 |
| 30 | 22 | 9·312194 | 11 110 | 10·687806 | 9·321536 | 11 115 | 10·678464 | 10·009342 | 11 5 | 9·990658 | 38 | 30 |
| 51 | 24 | 9·312495 | 12 120 | 10·687505 | 9·321851 | 12 125 | 10·678149 | 10·009355 | 12 5 | 9·990645 | 36 | 9 |
| 30 | 26 | 9·312796 | 13 130 | 10·687204 | 9·322165 | 13 136 | 10·677835 | 10·009369 | 13 6 | 9·990631 | 34 | 30 |
| 52 | 28 | 9·313097 | 14 140 | 10·686903 | 9·322479 | 14 146 | 10·677521 | 10·009382 | 14 6 | 9·990618 | 32 | 8 |
| 30 | 30 | 9·313397 | 15 150 | 10·686603 | 9·322793 | 15 157 | 10·677207 | 10·009395 | 15 7 | 9·990605 | 30 | 30 |
| 53 | 32 | 9·313698 | 16 160 | 10·686302 | 9·323106 | 16 167 | 10·676894 | 10·009409 | 16 7 | 9·990591 | 28 | 7 |
| 30 | 34 | 9·313998 | 17 170 | 10·686002 | 9·323420 | 17 178 | 10·676580 | 10·009422 | 17 8 | 9·990578 | 26 | 30 |
| 54 | 36 | 9·314297 | 18 180 | 10·685703 | 9·323733 | 18 188 | 10·676267 | 10·009435 | 18 8 | 9·990565 | 24 | 6 |
| 30 | 38 | 9·314597 | 19 190 | 10·685403 | 9·324046 | 19 199 | 10·675954 | 10·009449 | 19 8 | 9·990552 | 22 | 30 |
| 55 | 40 | 9·314897 | 20 200 | 10·685103 | 9·324358 | 20 209 | 10·675642 | 10·009462 | 20 9 | 9·990538 | 20 | 5 |
| 30 | 42 | 9·315196 | 21 210 | 10·684804 | 9·324671 | 21 219 | 10·675329 | 10·009475 | 21 9 | 9·990525 | 18 | 30 |
| 56 | 44 | 9·315495 | 22 220 | 10·684505 | 9·324983 | 22 230 | 10·675017 | 10·009489 | 22 10 | 9·990511 | 16 | 4 |
| 30 | 46 | 9·315793 | 23 230 | 10·684207 | 9·325295 | 23 240 | 10·674705 | 10·009502 | 23 10 | 9·990498 | 14 | 30 |
| 57 | 48 | 9·316092 | 24 240 | 10·683908 | 9·325607 | 24 251 | 10·674393 | 10·009515 | 24 11 | 9·990485 | 12 | 3 |
| 30 | 50 | 9·316390 | 25 250 | 10·683610 | 9·325919 | 25 261 | 10·674081 | 10·009529 | 25 11 | 9·990471 | 10 | 30 |
| 58 | 52 | 9·316689 | 26 260 | 10·683311 | 9·326231 | 26 272 | 10·673769 | 10·009542 | 26 12 | 9·990458 | 8 | 2 |
| 30 | 54 | 9·316986 | 27 270 | 10·683014 | 9·326542 | 27 282 | 10·673458 | 10·009555 | 27 12 | 9·990445 | 6 | 30 |
| 59 | 56 | 9·317284 | 28 280 | 10·682716 | 9·326853 | 28 293 | 10·673147 | 10·009569 | 28 12 | 9·990431 | 4 | 1 |
| 30 | 58 | 9·317582 | 29 290 | 10·682418 | 9·327164 | 29 303 | 10·672836 | 10·009582 | 29 13 | 9·990418 | 2 | 30 |
| 60 | 48 | 9·317879 | 30 300 | 10·682121 | 9·327475 | 30 313 | 10·672525 | 10·009596 | 30 13 | 9·990404 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

78° — 5h 12m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

0ʰ 48ᵐ — 12°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·317879 | | 10·682121 | 9·327475 | | 10·672525 | 10·009596 | | 9·990404 | 12 | 60 |
| 30 | 2 | 9·318176 | 1″ 10 | 10·681824 | 9·327785 | 1″ 10 | 10·672215 | 10·009609 | 1″ 0 | 9·990391 | 58 | 30 |
| 1 | 4 | 9·318473 | 2 20 | 10·681527 | 9·328095 | 2 20 | 10·671905 | 10·009622 | 2 1 | 9·990378 | 56 | 59 |
| 30 | 6 | 9·318769 | 3 29 | 10·681231 | 9·328405 | 3 31 | 10·671595 | 10·009636 | 4 1 | 9·990364 | 54 | 30 |
| 2 | 8 | 9·319066 | 4 39 | 10·680934 | 9·328715 | 4 41 | 10·671285 | 10·009649 | 4 2 | 9·990351 | 52 | 58 |
| 30 | 10 | 9·319362 | 5 49 | 10·680638 | 9·329025 | 5 51 | 10·670975 | 10·009663 | 5 2 | 9·990337 | 50 | 30 |
| 3 | 12 | 9·319658 | 6 59 | 10·680342 | 9·329334 | 6 61 | 10·670666 | 10·009676 | 6 3 | 9·990324 | 48 | 57 |
| 30 | 14 | 9·319954 | 7 69 | 10·680046 | 9·329644 | 7 72 | 10·670356 | 10·009690 | 7 3 | 9·990310 | 46 | 30 |
| 4 | 16 | 9·320249 | 8 78 | 10·679751 | 9·329953 | 8 82 | 10·670047 | 10·009703 | 8 4 | 9·990297 | 44 | 56 |
| 30 | 18 | 9·320545 | 9 88 | 10·679455 | 9·330262 | 9 92 | 10·669738 | 10·009717 | 9 4 | 9·990283 | 42 | 30 |
| 5 | 20 | 9·320840 | 10 98 | 10·679160 | 9·330570 | 10 102 | 10·669430 | 10·009730 | 10 5 | 9·990270 | 40 | 55 |
| 30 | 22 | 9·321135 | 11 108 | 10·678865 | 9·330879 | 11 113 | 10·669121 | 10·009744 | 11 5 | 9·990256 | 38 | 30 |
| 6 | 24 | 9·321430 | 12 118 | 10·678570 | 9·331187 | 12 123 | 10·668813 | 10·009757 | 12 5 | 9·990243 | 36 | 54 |
| 30 | 26 | 9·321724 | 13 127 | 10·678276 | 9·331495 | 13 133 | 10·668505 | 10·009771 | 13 6 | 9·990229 | 34 | 30 |
| 7 | 28 | 9·322019 | 14 137 | 10·677981 | 9·331803 | 14 143 | 10·668197 | 10·009785 | 14 6 | 9·990215 | 32 | 53 |
| 30 | 30 | 9·322313 | 15 147 | 10·677687 | 9·332111 | 15 154 | 10·667889 | 10·009798 | 15 7 | 9·990202 | 30 | 30 |
| 8 | 32 | 9·322607 | 16 157 | 10·677393 | 9·332418 | 16 164 | 10·667582 | 10·009812 | 16 7 | 9·990188 | 28 | 52 |
| 30 | 34 | 9·322900 | 17 167 | 10·677100 | 9·332726 | 17 174 | 10·667274 | 10·009825 | 17 8 | 9·990175 | 26 | 30 |
| 9 | 36 | 9·323194 | 18 176 | 10·676806 | 9·333033 | 18 184 | 10·666967 | 10·009839 | 18 8 | 9·990161 | 24 | 51 |
| 30 | 38 | 9·323487 | 19 186 | 10·676513 | 9·333340 | 19 195 | 10·666660 | 10·009852 | 19 9 | 9·990148 | 22 | 30 |
| 10 | 40 | 9·323780 | 20 196 | 10·676220 | 9·333646 | 20 205 | 10·666354 | 10·009866 | 20 9 | 9·990134 | 20 | 50 |
| 30 | 42 | 9·324073 | 21 206 | 10·675927 | 9·333953 | 21 215 | 10·666047 | 10·009880 | 21 9 | 9·990120 | 18 | 30 |
| 11 | 44 | 9·324366 | 22 216 | 10·675634 | 9·334259 | 22 225 | 10·665741 | 10·009893 | 22 10 | 9·990107 | 16 | 49 |
| 30 | 46 | 9·324658 | 23 225 | 10·675342 | 9·334565 | 23 236 | 10·665435 | 10·009907 | 23 10 | 9·990093 | 14 | 30 |
| 12 | 48 | 9·324950 | 24 235 | 10·675050 | 9·334871 | 24 246 | 10·665129 | 10·009921 | 24 11 | 9·990079 | 12 | 48 |
| 30 | 50 | 9·325243 | 25 245 | 10·674757 | 9·335177 | 25 256 | 10·664823 | 10·009934 | 25 11 | 9·990066 | 10 | 30 |
| 13 | 52 | 9·325534 | 26 255 | 10·674466 | 9·335482 | 26 266 | 10·664518 | 10·009948 | 26 12 | 9·990052 | 8 | 47 |
| 30 | 54 | 9·325826 | 27 265 | 10·674174 | 9·335788 | 27 277 | 10·664212 | 10·009962 | 27 12 | 9·990038 | 6 | 30 |
| 14 | 56 | 9·326117 | 28 274 | 10·673883 | 9·336093 | 28 287 | 10·663907 | 10·009975 | 28 13 | 9·990025 | 4 | 46 |
| 30 | 58 | 9·326409 | 29 284 | 10·673591 | 9·336398 | 29 297 | 10·663602 | 10·009989 | 29 13 | 9·990011 | 2 | 30 |
| 15 | **49** | 9·326700 | 30 294 | 10·673300 | 9·336702 | 30 307 | 10·663298 | 10·010003 | 30 14 | 9·989997 | **11** | 45 |
| 30 | 2 | 9·326991 | 1 10 | 10·673009 | 9·337007 | 1 10 | 10·662993 | 10·010016 | 1 0 | 9·989984 | 58 | 30 |
| 16 | 4 | 9·327281 | 2 19 | 10·672719 | 9·337311 | 2 20 | 10·662689 | 10·010030 | 2 1 | 9·989970 | 56 | 44 |
| 30 | 6 | 9·327572 | 3 29 | 10·672428 | 9·337615 | 3 30 | 10·662385 | 10·010044 | 3 1 | 9·989956 | 54 | 30 |
| 17 | 8 | 9·327862 | 4 38 | 10·672138 | 9·337919 | 4 40 | 10·662081 | 10·010058 | 4 2 | 9·989942 | 52 | 43 |
| 30 | 10 | 9·328152 | 5 48 | 10·671848 | 9·338223 | 5 50 | 10·661777 | 10·010071 | 5 2 | 9·989929 | 50 | 30 |
| 18 | 12 | 9·328442 | 6 58 | 10·671558 | 9·338527 | 6 60 | 10·661473 | 10·010085 | 6 3 | 9·989915 | 48 | 42 |
| 30 | 14 | 9·328731 | 7 67 | 10·671269 | 9·338830 | 7 70 | 10·661170 | 10·010099 | 7 3 | 9·989901 | 46 | 30 |
| 19 | 16 | 9·329021 | 8 77 | 10·670979 | 9·339133 | 8 80 | 10·660867 | 10·010113 | 8 4 | 9·989887 | 44 | 41 |
| 30 | 18 | 9·329310 | 9 86 | 10·670690 | 9·339436 | 9 90 | 10·660564 | 10·010127 | 9 4 | 9·989873 | 42 | 30 |
| 20 | 20 | 9·329599 | 10 96 | 10·670401 | 9·339739 | 10 101 | 10·660261 | 10·010140 | 10 5 | 9·989860 | 40 | 40 |
| 30 | 22 | 9·329888 | 11 106 | 10·670112 | 9·340042 | 11 111 | 10·659958 | 10·010154 | 11 5 | 9·989846 | 38 | 30 |
| 21 | 24 | 9·330176 | 12 115 | 10·669824 | 9·340344 | 12 121 | 10·659656 | 10·010168 | 12 5 | 9·989832 | 36 | 39 |
| 30 | 26 | 9·330465 | 13 125 | 10·669535 | 9·340646 | 13 131 | 10·659354 | 10·010182 | 13 6 | 9·989818 | 34 | 30 |
| 22 | 28 | 9·330753 | 14 134 | 10·669247 | 9·340948 | 14 141 | 10·659052 | 10·010196 | 14 6 | 9·989804 | 32 | 38 |
| 30 | 30 | 9·331041 | 15 144 | 10·668959 | 9·341250 | 15 151 | 10·658750 | 10·010210 | 15 7 | 9·989790 | 30 | 30 |
| 23 | 32 | 9·331320 | 16 154 | 10·668671 | 9·341552 | 16 161 | 10·658448 | 10·010223 | 16 7 | 9·989777 | 28 | 37 |
| 30 | 34 | 9·331616 | 17 163 | 10·668384 | 9·341853 | 17 171 | 10·658147 | 10·010237 | 17 8 | 9·989763 | 26 | 30 |
| 24 | 36 | 9·331903 | 18 173 | 10·668097 | 9·342155 | 18 181 | 10·657845 | 10·010251 | 18 8 | 9·989749 | 24 | 36 |
| 30 | 38 | 9·332191 | 19 182 | 10·667809 | 9·342456 | 19 191 | 10·657544 | 10·010265 | 19 9 | 9·989735 | 22 | 30 |
| 25 | 40 | 9·332478 | 20 192 | 10·667522 | 9·342757 | 20 201 | 10·657243 | 10·010279 | 20 9 | 9·989721 | 20 | 35 |
| 30 | 42 | 9·332764 | 21 202 | 10·667236 | 9·343057 | 21 211 | 10·656943 | 10·010293 | 21 9 | 9·989707 | 18 | 30 |
| 26 | 44 | 9·333051 | 22 211 | 10·666949 | 9·343358 | 22 221 | 10·656642 | 10·010307 | 22 10 | 9·989693 | 16 | 34 |
| 30 | 46 | 9·333337 | 23 221 | 10·666663 | 9·343658 | 23 231 | 10·656342 | 10·010321 | 23 10 | 9·989679 | 14 | 30 |
| 27 | 48 | 9·333624 | 24 230 | 10·666376 | 9·343958 | 24 241 | 10·656042 | 10·010335 | 24 11 | 9·989665 | 12 | 33 |
| 30 | 50 | 9·333910 | 25 240 | 10·666090 | 9·344258 | 25 252 | 10·655742 | 10·010349 | 25 11 | 9·989651 | 10 | 30 |
| 28 | 52 | 9·334195 | 26 250 | 10·665805 | 9·344558 | 26 262 | 10·655442 | 10·010363 | 26 12 | 9·989637 | 8 | 32 |
| 30 | 54 | 9·334481 | 27 259 | 10·665519 | 9·344858 | 27 272 | 10·655142 | 10·010377 | 27 12 | 9·989623 | 6 | 30 |
| 29 | 56 | 9·334767 | 28 269 | 10·665233 | 9·345157 | 28 282 | 10·654843 | 10·010390 | 28 13 | 9·989610 | 4 | 31 |
| 30 | 58 | 9·335052 | 29 278 | 10·664948 | 9·345456 | 29 292 | 10·654544 | 10·010404 | 29 13 | 9·989596 | 2 | 30 |
| 30 | **50** | 9·335337 | 30 288 | 10·664663 | 9·345755 | 30 302 | 10·654245 | 10·010418 | 30 14 | 9·989582 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

77° — 5ʰ 10ᵐ

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

0ʰ 50ᵐ — 12°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·335337 | | 10·664663 | 9·345755 | | 10·654245 | 10·010418 | | 9·989582 | 10 | 30 |
| 30 | 2 | 9·335622 | 1″ 9 | 10·664378 | 9·346054 | 1″ 10 | 10·653946 | 10·010432 | 1″ 0 | 9·989568 | 58 | 30 |
| 31 | 4 | 9·335906 | 2 19 | 10·664094 | 9·346353 | 2 20 | 10·653647 | 10·010447 | 2 1 | 9·989553 | 56 | 29 |
| 30 | 6 | 9·336191 | 3 28 | 10·663809 | 9·346651 | 3 30 | 10·653349 | 10·010461 | 3 1 | 9·989539 | 54 | 30 |
| 32 | 8 | 9·336475 | 4 38 | 10·663525 | 9·346949 | 4 39 | 10·653051 | 10·010475 | 4 2 | 9·989525 | 52 | 28 |
| 30 | 10 | 9·336759 | 5 47 | 10·663241 | 9·347248 | 5 49 | 10·652752 | 10·010489 | 5 2 | 9·989511 | 50 | 30 |
| 33 | 12 | 9·337043 | 6 56 | 10·662957 | 9·347545 | 6 59 | 10·652455 | 10·010503 | 6 3 | 9·989497 | 48 | 27 |
| 30 | 14 | 9·337326 | 7 66 | 10·662674 | 9·347843 | 7 69 | 10·652157 | 10·010517 | 7 3 | 9·989483 | 46 | 30 |
| 34 | 16 | 9·337610 | 8 75 | 10·662390 | 9·348141 | 8 80 | 10·651859 | 10·010531 | 8 4 | 9·989469 | 44 | 26 |
| 30 | 18 | 9·337893 | 9 85 | 10·662107 | 9·348438 | 9 89 | 10·651562 | 10·010545 | 9 4 | 9·989455 | 42 | 30 |
| 35 | 20 | 9·338176 | 10 94 | 10·661824 | 9·348735 | 10 99 | 10·651265 | 10·010559 | 10 5 | 9·989441 | 40 | 25 |
| 30 | 22 | 9·338459 | 11 103 | 10·661541 | 9·349032 | 11 109 | 10·650968 | 10·010573 | 11 5 | 9·989427 | 38 | 30 |
| 36 | 24 | 9·338742 | 12 113 | 10·661258 | 9·349329 | 12 118 | 10·650671 | 10·010587 | 12 6 | 9·989413 | 36 | 24 |
| 30 | 26 | 9·339024 | 13 122 | 10·660976 | 9·349626 | 13 128 | 10·650374 | 10·010601 | 13 6 | 9·989399 | 34 | 30 |
| 37 | 28 | 9·339307 | 14 132 | 10·660693 | 9·349922 | 14 138 | 10·650078 | 10·010615 | 14 7 | 9·989385 | 32 | 23 |
| 30 | 30 | 9·339589 | 15 141 | 10·660411 | 9·350218 | 15 148 | 10·649782 | 10·010630 | 15 7 | 9·989370 | 30 | 30 |
| 38 | 32 | 9·339871 | 16 150 | 10·660129 | 9·350514 | 16 158 | 10·649486 | 10·010644 | 16 8 | 9·989356 | 28 | 22 |
| 30 | 34 | 9·340152 | 17 160 | 10·659848 | 9·350810 | 17 168 | 10·649190 | 10·010658 | 17 8 | 9·989342 | 26 | 30 |
| 39 | 36 | 9·340434 | 18 169 | 10·659566 | 9·351106 | 18 178 | 10·648894 | 10·010672 | 18 8 | 9·989328 | 24 | 21 |
| 30 | 38 | 9·340715 | 19 179 | 10·659285 | 9·351401 | 19 188 | 10·648599 | 10·010686 | 19 9 | 9·989314 | 22 | 30 |
| 40 | 40 | 9·340996 | 20 188 | 10·659004 | 9·351697 | 20 197 | 10·648303 | 10·010700 | 20 9 | 9·989300 | 20 | 20 |
| 30 | 42 | 9·341277 | 21 197 | 10·658723 | 9·351992 | 21 207 | 10·648008 | 10·010715 | 21 10 | 9·989285 | 18 | 30 |
| 41 | 44 | 9·341558 | 22 207 | 10·658442 | 9·352287 | 22 217 | 10·647713 | 10·010729 | 22 10 | 9·989271 | 16 | 19 |
| 30 | 46 | 9·341839 | 23 216 | 10·658161 | 9·352582 | 23 227 | 10·647418 | 10·010743 | 23 11 | 9·989257 | 14 | 30 |
| 42 | 48 | 9·342119 | 24 226 | 10·657881 | 9·352876 | 24 237 | 10·647124 | 10·010757 | 24 11 | 9·989243 | 12 | 18 |
| 30 | 50 | 9·342399 | 25 235 | 10·657601 | 9·353171 | 25 247 | 10·646829 | 10·010772 | 25 12 | 9·989228 | 10 | 30 |
| 43 | 52 | 9·342679 | 26 244 | 10·657321 | 9·353465 | 26 257 | 10·646535 | 10·010786 | 26 12 | 9·989214 | 8 | 17 |
| 30 | 54 | 9·342959 | 27 254 | 10·657041 | 9·353759 | 27 266 | 10·646241 | 10·010800 | 27 13 | 9·989200 | 6 | 30 |
| 44 | 56 | 9·343239 | 28 263 | 10·656761 | 9·354053 | 28 276 | 10·645947 | 10·010814 | 28 13 | 9·989186 | 4 | 16 |
| 30 | 58 | 9·343518 | 29 273 | 10·656482 | 9·354347 | 29 286 | 10·645653 | 10·010829 | 29 14 | 9·989171 | 2 | 30 |
| 45 | **51** | 9·343797 | 30 282 | 10·656203 | 9·354640 | 30 296 | 10·645360 | 10·010843 | 30 14 | 9·989157 | **9** | 15 |
| 30 | 2 | 9·344076 | 1 9 | 10·655924 | 9·354934 | 1 10 | 10·645066 | 10·010857 | 1 0 | 9·989143 | 58 | 30 |
| 46 | 4 | 9·344355 | 2 18 | 10·655645 | 9·355227 | 2 19 | 10·644773 | 10·010872 | 2 1 | 9·989128 | 56 | 14 |
| 30 | 6 | 9·344634 | 3 28 | 10·655366 | 9·355520 | 3 29 | 10·644480 | 10·010886 | 3 1 | 9·989114 | 54 | 30 |
| 47 | 8 | 9·344912 | 4 37 | 10·655088 | 9·355813 | 4 39 | 10·644187 | 10·010900 | 4 2 | 9·989100 | 52 | 13 |
| 30 | 10 | 9·345191 | 5 46 | 10·654809 | 9·356105 | 5 48 | 10·643895 | 10·010915 | 5 2 | 9·989085 | 50 | 30 |
| 48 | 12 | 9·345469 | 6 55 | 10·654531 | 9·356398 | 6 58 | 10·643602 | 10·010929 | 6 3 | 9·989071 | 48 | 12 |
| 30 | 14 | 9·345747 | 7 64 | 10·654253 | 9·356690 | 7 68 | 10·643310 | 10·010943 | 7 3 | 9·989057 | 46 | 30 |
| 49 | 16 | 9·346024 | 8 73 | 10·653976 | 9·356982 | 8 77 | 10·643018 | 10·010958 | 8 4 | 9·989042 | 44 | 11 |
| 30 | 18 | 9·346302 | 9 83 | 10·653698 | 9·357274 | 9 87 | 10·642726 | 10·010972 | 9 4 | 9·989028 | 42 | 30 |
| 50 | 20 | 9·346579 | 10 92 | 10·653421 | 9·357566 | 10 97 | 10·642434 | 10·010986 | 10 5 | 9·989014 | 40 | 10 |
| 30 | 22 | 9·346857 | 11 101 | 10·653143 | 9·357857 | 11 106 | 10·642143 | 10·011001 | 11 5 | 9·988999 | 38 | 30 |
| 51 | 24 | 9·347134 | 12 111 | 10·652866 | 9·358149 | 12 116 | 10·641851 | 10·011015 | 12 6 | 9·988985 | 36 | 9 |
| 30 | 26 | 9·347410 | 13 120 | 10·652590 | 9·358440 | 13 126 | 10·641560 | 10·011030 | 13 6 | 9·988970 | 34 | 30 |
| 52 | 28 | 9·347687 | 14 129 | 10·652313 | 9·358731 | 14 135 | 10·641269 | 10·011044 | 14 7 | 9·988956 | 32 | 8 |
| 30 | 30 | 9·347963 | 15 138 | 10·652037 | 9·359022 | 15 145 | 10·640978 | 10·011058 | 15 7 | 9·988942 | 30 | 30 |
| 53 | 32 | 9·348240 | 16 147 | 10·651760 | 9·359313 | 16 155 | 10·640687 | 10·011073 | 16 8 | 9·988927 | 28 | 7 |
| 30 | 34 | 9·348516 | 17 157 | 10·651484 | 9·359603 | 17 164 | 10·640397 | 10·011087 | 17 8 | 9·988913 | 26 | 30 |
| 54 | 36 | 9·348792 | 18 166 | 10·651208 | 9·359893 | 18 174 | 10·640107 | 10·011102 | 18 9 | 9·988898 | 24 | 6 |
| 30 | 38 | 9·349067 | 19 175 | 10·650933 | 9·360184 | 19 184 | 10·639816 | 10·011116 | 19 9 | 9·988884 | 22 | 30 |
| 55 | 40 | 9·349343 | 20 184 | 10·650657 | 9·360474 | 20 193 | 10·639526 | 10·011131 | 20 10 | 9·988869 | 20 | 5 |
| 30 | 42 | 9·349618 | 21 193 | 10·650382 | 9·360763 | 21 203 | 10·639237 | 10·011145 | 21 10 | 9·988855 | 18 | 30 |
| 56 | 44 | 9·349893 | 22 203 | 10·650107 | 9·361053 | 22 213 | 10·638947 | 10·011160 | 22 11 | 9·988840 | 16 | 4 |
| 30 | 46 | 9·350168 | 23 212 | 10·649832 | 9·361343 | 23 222 | 10·638657 | 10·011174 | 23 11 | 9·988826 | 14 | 30 |
| 57 | 48 | 9·350443 | 24 221 | 10·649557 | 9·361632 | 24 232 | 10·638368 | 10·011189 | 24 12 | 9·988811 | 12 | 3 |
| 30 | 50 | 9·350718 | 25 230 | 10·649282 | 9·361921 | 25 242 | 10·638079 | 10·011203 | 25 12 | 9·988797 | 10 | 30 |
| 58 | 52 | 9·350992 | 26 239 | 10·649008 | 9·362210 | 26 251 | 10·637790 | 10·011218 | 26 12 | 9·988782 | 8 | 2 |
| 30 | 54 | 9·351266 | 27 249 | 10·648734 | 9·362499 | 27 261 | 10·637501 | 10·011232 | 27 13 | 9·988768 | 6 | 30 |
| 59 | 56 | 9·351540 | 28 258 | 10·648460 | 9·362787 | 28 271 | 10·637213 | 10·011247 | 28 13 | 9·988753 | 4 | 1 |
| 30 | 58 | 9·351814 | 29 267 | 10·648186 | 9·363076 | 29 280 | 10·636924 | 10·011261 | 29 14 | 9·988739 | 2 | 30 |
| 60 | **52** | 9·352088 | 30 276 | 10·647912 | 9·363364 | 30 290 | 10·636636 | 10·011276 | 30 14 | 9·988724 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

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## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

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| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·352088 | | 10·647912 | 9·363364 | | 10·636636 | 10·011276 | | 9·988724 | 8 | 60 |
| 30 | 2 | 9·352362 | 1″ 9 | 10·647638 | 9·363652 | 1″ 10 | 10·636348 | 10·011291 | 1″ 0 | 9·988709 | 58 | 30 |
| 1 | 4 | 9·352635 | 2 18 | 10·647365 | 9·363940 | 2 19 | 10·636060 | 10·011305 | 2 1 | 9·988695 | 56 | 59 |
| 30 | 6 | 9·352908 | 3 27 | 10·647092 | 9·364228 | 3 29 | 10·635772 | 10·011320 | 3 1 | 9·988680 | 54 | 30 |
| 2 | 8 | 9·353181 | 4 36 | 10·646819 | 9·364515 | 4 38 | 10·635485 | 10·011334 | 4 2 | 9·988666 | 52 | 58 |
| 30 | 10 | 9·353454 | 5 45 | 10·646546 | 9·364803 | 5 48 | 10·635197 | 10·011349 | 5 2 | 9·988651 | 50 | 30 |
| 3 | 12 | 9·353726 | 6 54 | 10·646274 | 9·365090 | 6 57 | 10·634910 | 10·011364 | 6 3 | 9·988636 | 48 | 57 |
| 30 | 14 | 9·353999 | 7 63 | 10·646001 | 9·365377 | 7 67 | 10·634623 | 10·011378 | 7 3 | 9·988622 | 46 | 30 |
| 4 | 16 | 9·354271 | 8 72 | 10·645729 | 9·365664 | 8 76 | 10·634336 | 10·011393 | 8 4 | 9·988607 | 44 | 56 |
| 30 | 18 | 9·354543 | 9 81 | 10·645457 | 9·365951 | 9 86 | 10·634049 | 10·011408 | 9 4 | 9·988592 | 42 | 30 |
| 5 | 20 | 9·354815 | 10 90 | 10·645185 | 9·366237 | 10 95 | 10·633763 | 10·011422 | 10 5 | 9·988578 | 40 | 55 |
| 30 | 22 | 9·355087 | 11 99 | 10·644913 | 9·366524 | 11 105 | 10·633476 | 10·011437 | 11 5 | 9·988563 | 38 | 30 |
| 6 | 24 | 9·355358 | 12 108 | 10·644642 | 9·366810 | 12 114 | 10·633190 | 10·011452 | 12 6 | 9·988548 | 36 | 54 |
| 30 | 26 | 9·355630 | 13 117 | 10·644370 | 9·367096 | 13 124 | 10·632904 | 10·011466 | 13 6 | 9·988534 | 34 | 30 |
| 7 | 28 | 9·355901 | 14 126 | 10·644099 | 9·367382 | 14 133 | 10·632618 | 10·011481 | 14 7 | 9·988519 | 32 | 53 |
| 30 | 30 | 9·356172 | 15 135 | 10·643828 | 9·367668 | 15 143 | 10·632332 | 10·011496 | 15 7 | 9·988504 | 30 | 30 |
| 8 | 32 | 9·356443 | 16 144 | 10·643557 | 9·367953 | 16 152 | 10·632047 | 10·011511 | 16 8 | 9·988489 | 28 | 52 |
| 30 | 34 | 9·356713 | 17 153 | 10·643287 | 9·368239 | 17 162 | 10·631761 | 10·011525 | 17 8 | 9·988475 | 26 | 30 |
| 9 | 36 | 9·356984 | 18 162 | 10·643016 | 9·368524 | 18 171 | 10·631476 | 10·011540 | 18 9 | 9·988460 | 24 | 51 |
| 30 | 38 | 9·357254 | 19 171 | 10·642746 | 9·368809 | 19 181 | 10·631191 | 10·011555 | 19 9 | 9·988445 | 22 | 30 |
| 10 | 40 | 9·357524 | 20 181 | 10·642476 | 9·369094 | 20 190 | 10·630906 | 10·011570 | 20 10 | 9·988430 | 20 | 50 |
| 30 | 42 | 9·357794 | 21 190 | 10·642206 | 9·369378 | 21 200 | 10·630622 | 10·011584 | 21 10 | 9·988416 | 18 | 30 |
| 11 | 44 | 9·358064 | 22 199 | 10·641936 | 9·369663 | 22 209 | 10·630337 | 10·011599 | 22 11 | 9·988401 | 16 | 49 |
| 30 | 46 | 9·358333 | 23 208 | 10·641667 | 9·369947 | 23 219 | 10·630053 | 10·011614 | 23 11 | 9·988386 | 14 | 30 |
| 12 | 48 | 9·358603 | 24 217 | 10·641397 | 9·370232 | 24 228 | 10·629768 | 10·011629 | 24 12 | 9·988371 | 12 | 48 |
| 30 | 50 | 9·358872 | 25 226 | 10·641128 | 9·370516 | 25 238 | 10·629484 | 10·011644 | 25 12 | 9·988356 | 10 | 30 |
| 13 | 52 | 9·359141 | 26 235 | 10·640859 | 9·370799 | 26 248 | 10·629201 | 10·011658 | 26 13 | 9·988342 | 8 | 47 |
| 30 | 54 | 9·359410 | 27 244 | 10·640590 | 9·371083 | 27 257 | 10·628917 | 10·011673 | 27 13 | 9·988327 | 6 | 30 |
| 14 | 56 | 9·359678 | 28 253 | 10·640322 | 9·371367 | 28 267 | 10·628633 | 10·011688 | 28 14 | 9·988312 | 4 | 46 |
| 30 | 58 | 9·359947 | 29 262 | 10·640053 | 9·371650 | 29 276 | 10·628350 | 10·011703 | 29 14 | 9·988297 | 2 | 30 |
| 15 | 53 | 9·360215 | 30 271 | 10·639785 | 9·371933 | 30 286 | 10·628067 | 10·011718 | 30 15 | 9·988282 | 7 | 45 |
| 30 | 2 | 9·360484 | 1 9 | 10·639516 | 9·372216 | 1 10 | 10·627784 | 10·011733 | 1 0 | 9·988267 | 58 | 30 |
| 16 | 4 | 9·360752 | 2 18 | 10·639248 | 9·372499 | 2 19 | 10·627501 | 10·011748 | 2 1 | 9·988252 | 56 | 44 |
| 30 | 6 | 9·361019 | 3 26 | 10·638981 | 9·372782 | 3 28 | 10·627218 | 10·011763 | 3 1 | 9·988237 | 54 | 30 |
| 17 | 8 | 9·361287 | 4 35 | 10·638713 | 9·373064 | 4 37 | 10·626936 | 10·011777 | 4 2 | 9·988223 | 52 | 43 |
| 30 | 10 | 9·361554 | 5 44 | 10·638446 | 9·373347 | 5 47 | 10·626653 | 10·011792 | 5 2 | 9·988208 | 50 | 30 |
| 18 | 12 | 9·361822 | 6 53 | 10·638178 | 9·373629 | 6 56 | 10·626371 | 10·011807 | 6 3 | 9·988193 | 48 | 42 |
| 30 | 14 | 9·362089 | 7 62 | 10·637911 | 9·373911 | 7 65 | 10·626089 | 10·011822 | 7 3 | 9·988178 | 46 | 30 |
| 19 | 16 | 9·362356 | 8 70 | 10·637644 | 9·374193 | 8 75 | 10·625807 | 10·011837 | 8 4 | 9·988163 | 44 | 41 |
| 30 | 18 | 9·362623 | 9 79 | 10·637377 | 9·374475 | 9 84 | 10·625525 | 10·011852 | 9 4 | 9·988148 | 42 | 30 |
| 20 | 20 | 9·362889 | 10 88 | 10·637111 | 9·374756 | 10 93 | 10·625244 | 10·011867 | 10 5 | 9·988133 | 40 | 40 |
| 30 | 22 | 9·363156 | 11 97 | 10·636844 | 9·375038 | 11 103 | 10·624962 | 10·011882 | 11 5 | 9·988118 | 38 | 30 |
| 21 | 24 | 9·363422 | 12 106 | 10·636578 | 9·375319 | 12 112 | 10·624681 | 10·011897 | 12 6 | 9·988103 | 36 | 39 |
| 30 | 26 | 9·363688 | 13 115 | 10·636312 | 9·375600 | 13 122 | 10·624400 | 10·011912 | 13 6 | 9·988088 | 34 | 30 |
| 22 | 28 | 9·363954 | 14 124 | 10·636046 | 9·375881 | 14 131 | 10·624119 | 10·011927 | 14 7 | 9·988073 | 32 | 38 |
| 30 | 30 | 9·364220 | 15 133 | 10·635780 | 9·376162 | 15 140 | 10·623838 | 10·011942 | 15 7 | 9·988058 | 30 | 30 |
| 23 | 32 | 9·364485 | 16 142 | 10·635515 | 9·376442 | 16 150 | 10·623558 | 10·011957 | 16 8 | 9·988043 | 28 | 37 |
| 30 | 34 | 9·364751 | 17 151 | 10·635249 | 9·376723 | 17 158 | 10·623277 | 10·011972 | 17 8 | 9·988028 | 26 | 30 |
| 24 | 36 | 9·365016 | 18 159 | 10·634984 | 9·377003 | 18 168 | 10·622997 | 10·011987 | 18 9 | 9·988013 | 24 | 36 |
| 30 | 38 | 9·365281 | 19 168 | 10·634719 | 9·377283 | 19 178 | 10·622717 | 10·012002 | 19 9 | 9·987998 | 22 | 30 |
| 25 | 40 | 9·365546 | 20 177 | 10·634454 | 9·377563 | 20 187 | 10·622437 | 10·012017 | 20 10 | 9·987983 | 20 | 35 |
| 30 | 42 | 9·365810 | 21 186 | 10·634190 | 9·377843 | 21 196 | 10·622157 | 10·012032 | 21 10 | 9·987968 | 18 | 30 |
| 26 | 44 | 9·366075 | 22 195 | 10·633925 | 9·378122 | 22 206 | 10·621878 | 10·012047 | 22 11 | 9·987953 | 16 | 34 |
| 30 | 46 | 9·366339 | 23 203 | 10·633661 | 9·378402 | 23 215 | 10·621598 | 10·012063 | 23 11 | 9·987937 | 14 | 30 |
| 27 | 48 | 9·366604 | 24 212 | 10·633396 | 9·378681 | 24 224 | 10·621319 | 10·012078 | 24 12 | 9·987922 | 12 | 33 |
| 30 | 50 | 9·366868 | 25 221 | 10·633132 | 9·378960 | 25 234 | 10·621040 | 10·012093 | 25 12 | 9·987907 | 10 | 30 |
| 28 | 52 | 9·367131 | 26 230 | 10·632869 | 9·379239 | 26 243 | 10·620761 | 10·012108 | 26 13 | 9·987892 | 8 | 32 |
| 30 | 54 | 9·367395 | 27 239 | 10·632605 | 9·379518 | 27 252 | 10·620482 | 10·012123 | 27 13 | 9·987877 | 6 | 30 |
| 29 | 56 | 9·367659 | 28 248 | 10·632341 | 9·379797 | 28 262 | 10·620203 | 10·012138 | 28 14 | 9·987862 | 4 | 31 |
| 30 | 58 | 9·367922 | 29 257 | 10·632078 | 9·380075 | 29 271 | 10·619925 | 10·012153 | 29 14 | 9·987847 | 2 | 30 |
| 30 | 54 | 9·368185 | 30 265 | 10·631815 | 9·380354 | 30 280 | 10·619646 | 10·012168 | 30 15 | 9·987832 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

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## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

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| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·368185 | | 10·631815 | 9·380354 | | 10·619646 | 10·012168 | | 9·987832 | 6 | 30 |
| 30 | 2 | 9·368448 | 1″ 9 | 10·631552 | 9·380632 | 1″ 9 | 10·619368 | 10·012184 | 1″ 1 | 9·987816 | 58 | 30 |
| 31 | 4 | 9·368711 | 2 17 | 10·631289 | 9·380910 | 2 18 | 10·619090 | 10·012199 | 2 1 | 9·987801 | 56 | 29 |
| 30 | 6 | 9·368974 | 3 26 | 10·631026 | 9·381188 | 3 28 | 10·618812 | 10·012214 | 3 2 | 9·987786 | 54 | 30 |
| 32 | 8 | 9·369236 | 4 35 | 10·630764 | 9·381466 | 4 37 | 10·618534 | 10·012229 | 4 2 | 9·987771 | 52 | 28 |
| 30 | 10 | 9·369499 | 5 43 | 10·630501 | 9·381743 | 5 46 | 10·618257 | 10·012244 | 5 3 | 9·987756 | 50 | 30 |
| 33 | 12 | 9·369761 | 6 52 | 10·630239 | 9·382020 | 6 55 | 10·617980 | 10·012260 | 6 3 | 9·987740 | 48 | 27 |
| 30 | 14 | 9·370023 | 7 61 | 10·629977 | 9·382298 | 7 64 | 10·617702 | 10·012275 | 7 4 | 9·987725 | 46 | 30 |
| 34 | 16 | 9·370285 | 8 70 | 10·629715 | 9·382575 | 8 74 | 10·617425 | 10·012290 | 8 4 | 9·987710 | 44 | 26 |
| 30 | 18 | 9·370546 | 9 78 | 10·629454 | 9·382852 | 9 83 | 10·617148 | 10·012305 | 9 5 | 9·987695 | 42 | 30 |
| 35 | 20 | 9·370808 | 10 87 | 10·629192 | 9·383129 | 10 92 | 10·616871 | 10·012321 | 10 5 | 9·987679 | 40 | 25 |
| 30 | 22 | 9·371069 | 11 95 | 10·628931 | 9·383405 | 11 101 | 10·616595 | 10·012336 | 11 6 | 9·987664 | 38 | 30 |
| 36 | 24 | 9·371330 | 12 104 | 10·628670 | 9·383682 | 12 110 | 10·616318 | 10·012351 | 12 6 | 9·987649 | 36 | 24 |
| 30 | 26 | 9·371591 | 13 113 | 10·628409 | 9·383958 | 13 120 | 10·616042 | 10·012366 | 13 7 | 9·987634 | 34 | 30 |
| 37 | 28 | 9·371852 | 14 122 | 10·628148 | 9·384234 | 14 129 | 10·615766 | 10·012382 | 14 7 | 9·987618 | 32 | 23 |
| 30 | 30 | 9·372113 | 15 130 | 10·627887 | 9·384510 | 15 138 | 10·615490 | 10·012397 | 15 8 | 9·987603 | 30 | 30 |
| 38 | 32 | 9·372373 | 16 139 | 10·627627 | 9·384786 | 16 147 | 10·615214 | 10·012412 | 16 8 | 9·987588 | 28 | 22 |
| 30 | 34 | 9·372634 | 17 148 | 10·627366 | 9·385062 | 17 156 | 10·614938 | 10·012428 | 17 9 | 9·987572 | 26 | 30 |
| 39 | 36 | 9·372894 | 18 156 | 10·627106 | 9·385337 | 18 166 | 10·614663 | 10·012443 | 18 9 | 9·987557 | 24 | 21 |
| 30 | 38 | 9·373154 | 19 165 | 10·626846 | 9·385612 | 19 175 | 10·614388 | 10·012458 | 19 10 | 9·987542 | 22 | 30 |
| 40 | 40 | 9·373414 | 20 174 | 10·626586 | 9·385888 | 20 184 | 10·614112 | 10·012474 | 20 10 | 9·987526 | 20 | 20 |
| 30 | 42 | 9·373674 | 21 182 | 10·626326 | 9·386163 | 21 193 | 10·613837 | 10·012489 | 21 11 | 9·987511 | 18 | 30 |
| 41 | 44 | 9·373933 | 22 191 | 10·626067 | 9·386438 | 22 202 | 10·613562 | 10·012504 | 22 11 | 9·987496 | 16 | 19 |
| 30 | 46 | 9·374192 | 23 200 | 10·625808 | 9·386712 | 23 212 | 10·613288 | 10·012520 | 23 12 | 9·987480 | 14 | 30 |
| 42 | 48 | 9·374452 | 24 208 | 10·625548 | 9·386987 | 24 221 | 10·613013 | 10·012535 | 24 12 | 9·987465 | 12 | 18 |
| 30 | 50 | 9·374711 | 25 217 | 10·625289 | 9·387261 | 25 230 | 10·612739 | 10·012551 | 25 13 | 9·987449 | 10 | 30 |
| 43 | 52 | 9·374970 | 26 226 | 10·625030 | 9·387536 | 26 239 | 10·612464 | 10·012566 | 26 13 | 9·987434 | 8 | 17 |
| 30 | 54 | 9·375228 | 27 235 | 10·624772 | 9·387810 | 27 248 | 10·612190 | 10·012581 | 27 14 | 9·987419 | 6 | 30 |
| 44 | 56 | 9·375487 | 28 243 | 10·624513 | 9·388084 | 28 258 | 10·611916 | 10·012597 | 28 14 | 9·987403 | 4 | 16 |
| 30 | 58 | 9·375745 | 29 252 | 10·624255 | 9·388358 | 29 267 | 10·611642 | 10·012612 | 29 15 | 9·987388 | 2 | 30 |
| 45 | 55 | 9·376003 | 30 261 | 10·623997 | 9·388631 | 30 276 | 10·611369 | 10·012628 | 30 15 | 9·987372 | 5 | 15 |
| 30 | 2 | 9·376261 | 1 8 | 10·623739 | 9·388905 | 1 9 | 10·611095 | 10·012643 | 1 1 | 9·987357 | 58 | 30 |
| 46 | 4 | 9·376519 | 2 17 | 10·623481 | 9·389178 | 2 18 | 10·610822 | 10·012659 | 2 1 | 9·987341 | 56 | 14 |
| 30 | 6 | 9·376777 | 3 25 | 10·623223 | 9·389451 | 3 27 | 10·610549 | 10·012674 | 3 2 | 9·987326 | 54 | 30 |
| 47 | 8 | 9·377035 | 4 34 | 10·622965 | 9·389724 | 4 36 | 10·610276 | 10·012690 | 4 2 | 9·987310 | 52 | 13 |
| 30 | 10 | 9·377292 | 5 42 | 10·622708 | 9·389997 | 5 45 | 10·610003 | 10·012705 | 5 3 | 9·987295 | 50 | 30 |
| 48 | 12 | 9·377549 | 6 51 | 10·622451 | 9·390270 | 6 54 | 10·609730 | 10·012721 | 6 3 | 9·987279 | 48 | 12 |
| 30 | 14 | 9·377806 | 7 59 | 10·622194 | 9·390543 | 7 63 | 10·609457 | 10·012736 | 7 4 | 9·987264 | 46 | 30 |
| 49 | 16 | 9·378063 | 8 68 | 10·621937 | 9·390815 | 8 72 | 10·609185 | 10·012752 | 8 4 | 9·987248 | 44 | 11 |
| 30 | 18 | 9·378320 | 9 76 | 10·621680 | 9·391087 | 9 81 | 10·608913 | 10·012767 | 9 5 | 9·987233 | 42 | 30 |
| 50 | 20 | 9·378577 | 10 85 | 10·621423 | 9·391360 | 10 90 | 10·608640 | 10·012783 | 10 5 | 9·987217 | 40 | 10 |
| 30 | 22 | 9·378833 | 11 94 | 10·621167 | 9·391632 | 11 99 | 10·608368 | 10·012798 | 11 6 | 9·987202 | 38 | 30 |
| 51 | 24 | 9·379089 | 12 102 | 10·620911 | 9·391903 | 12 108 | 10·608097 | 10·012814 | 12 6 | 9·987186 | 36 | 9 |
| 30 | 26 | 9·379346 | 13 111 | 10·620654 | 9·392175 | 13 118 | 10·607825 | 10·012830 | 13 7 | 9·987170 | 34 | 30 |
| 52 | 28 | 9·379601 | 14 119 | 10·620399 | 9·392447 | 14 127 | 10·607553 | 10·012845 | 14 7 | 9·987155 | 32 | 8 |
| 30 | 30 | 9·379857 | 15 128 | 10·620143 | 9·392718 | 15 136 | 10·607282 | 10·012861 | 15 8 | 9·987139 | 30 | 30 |
| 53 | 32 | 9·380113 | 16 136 | 10·619887 | 9·392989 | 16 145 | 10·607011 | 10·012876 | 16 8 | 9·987124 | 28 | 7 |
| 30 | 34 | 9·380368 | 17 145 | 10·619632 | 9·393260 | 17 154 | 10·606740 | 10·012892 | 17 9 | 9·987108 | 26 | 30 |
| 54 | 36 | 9·380624 | 18 153 | 10·619376 | 9·393531 | 18 163 | 10·606469 | 10·012908 | 18 9 | 9·987092 | 24 | 6 |
| 30 | 38 | 9·380879 | 19 162 | 10·619121 | 9·393802 | 19 172 | 10·606198 | 10·012923 | 19 10 | 9·987077 | 22 | 30 |
| 55 | 40 | 9·381134 | 20 170 | 10·618866 | 9·394073 | 20 181 | 10·605927 | 10·012939 | 20 10 | 9·987061 | 20 | 5 |
| 30 | 42 | 9·381389 | 21 179 | 10·618611 | 9·394343 | 21 190 | 10·605657 | 10·012955 | 21 11 | 9·987045 | 18 | 30 |
| 56 | 44 | 9·381643 | 22 187 | 10·618357 | 9·394614 | 22 199 | 10·605386 | 10·012970 | 22 11 | 9·987030 | 16 | 4 |
| 30 | 46 | 9·381898 | 23 196 | 10·618102 | 9·394884 | 23 208 | 10·605116 | 10·012986 | 23 12 | 9·987014 | 14 | 30 |
| 57 | 48 | 9·382152 | 24 204 | 10·617848 | 9·395154 | 24 217 | 10·604846 | 10·013002 | 24 12 | 9·986998 | 12 | 3 |
| 30 | 50 | 9·382406 | 25 213 | 10·617594 | 9·395424 | 25 226 | 10·604576 | 10·013017 | 25 13 | 9·986983 | 10 | 30 |
| 58 | 52 | 9·382661 | 26 222 | 10·617339 | 9·395694 | 26 235 | 10·604306 | 10·013033 | 26 14 | 9·986967 | 8 | 2 |
| 30 | 54 | 9·382914 | 27 230 | 10·617086 | 9·395963 | 27 244 | 10·604037 | 10·013049 | 27 14 | 9·986951 | 6 | 30 |
| 59 | 56 | 9·383168 | 28 239 | 10·616832 | 9·396233 | 28 253 | 10·603767 | 10·013064 | 28 15 | 9·986936 | 4 | 1 |
| 30 | 58 | 9·383422 | 29 247 | 10·616578 | 9·396502 | 29 262 | 10·603498 | 10·013080 | 29 15 | 9·986920 | 2 | 30 |
| 60 | 56 | 9·383675 | 30 256 | 10·616325 | 9·396771 | 30 271 | 10·603229 | 10·013096 | 30 16 | 9·986904 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant. | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |

76° 5h 4m

## TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

0h 56m — 14°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·383675 | | 10·616325 | 9·396771 | | 10·603229 | 10·013096 | | 9·986904 | 4 | 60 |
| 30 | 2 | 9·383928 | 1″ 8 | 10·616072 | 9·397040 | 1″ 9 | 10·602960 | 10·013112 | 1″ 1 | 9·986888 | 58 | 30 |
| 1 | 4 | 9·384182 | 2 17 | 10·615818 | 9·397309 | 2 18 | 10·602691 | 10·013127 | 2 1 | 9·986873 | 56 | 59 |
| 30 | 6 | 9·384435 | 3 25 | 10·615565 | 9·397578 | 3 27 | 10·602422 | 10·013143 | 3 2 | 9·986857 | 54 | 30 |
| 2 | 8 | 9·384687 | 4 33 | 10·615313 | 9·397846 | 4 36 | 10·602154 | 10·013159 | 4 2 | 9·986841 | 52 | 58 |
| 30 | 10 | 9·384940 | 5 42 | 10·615060 | 9·398115 | 5 44 | 10·601885 | 10·013175 | 5 3 | 9·986825 | 50 | 30 |
| 3 | 12 | 9·385192 | 6 50 | 10·614808 | 9·398383 | 6 53 | 10·601617 | 10·013191 | 6 3 | 9·986809 | 48 | 57 |
| 30 | 14 | 9·385445 | 7 59 | 10·614555 | 9·398651 | 7 62 | 10·601349 | 10·013206 | 7 4 | 9·986794 | 46 | 30 |
| 4 | 16 | 9·385697 | 8 67 | 10·614303 | 9·398919 | 8 71 | 10·601081 | 10·013222 | 8 4 | 9·986778 | 44 | 56 |
| 30 | 18 | 9·385949 | 9 75 | 10·614051 | 9·399187 | 9 80 | 10·600813 | 10·013238 | 9 5 | 9·986762 | 42 | 30 |
| 5 | 20 | 9·386201 | 10 84 | 10·613799 | 9·399455 | 10 89 | 10·600545 | 10·013254 | 10 5 | 9·986746 | 40 | 55 |
| 30 | 22 | 9·386452 | 11 92 | 10·613548 | 9·399722 | 11 98 | 10·600278 | 10·013270 | 11 6 | 9·986730 | 38 | 30 |
| 6 | 24 | 9·386704 | 12 100 | 10·613296 | 9·399990 | 12 107 | 10·600010 | 10·013286 | 12 6 | 9·986714 | 36 | 54 |
| 30 | 26 | 9·386955 | 13 109 | 10·613045 | 9·400257 | 13 116 | 10·599743 | 10·013301 | 13 7 | 9·986699 | 34 | 30 |
| 7 | 28 | 9·387207 | 14 118 | 10·612793 | 9·400524 | 14 125 | 10·599476 | 10·013317 | 14 7 | 9·986683 | 32 | 53 |
| 30 | 30 | 9·387458 | 15 126 | 10·612542 | 9·400791 | 15 133 | 10·599209 | 10·013333 | 15 8 | 9·986667 | 30 | 30 |
| 8 | 32 | 9·387709 | 16 134 | 10·612291 | 9·401058 | 16 142 | 10·598942 | 10·013349 | 16 8 | 9·986651 | 28 | 52 |
| 30 | 34 | 9·387959 | 17 142 | 10·612041 | 9·401325 | 17 151 | 10·598675 | 10·013365 | 17 9 | 9·986635 | 26 | 30 |
| 9 | 36 | 9·388210 | 18 150 | 10·611790 | 9·401591 | 18 160 | 10·598409 | 10·013381 | 18 10 | 9·986619 | 24 | 51 |
| 30 | 38 | 9·388461 | 19 159 | 10·611539 | 9·401857 | 19 169 | 10·598143 | 10·013397 | 19 10 | 9·986603 | 22 | 30 |
| 10 | 40 | 9·388711 | 20 167 | 10·611289 | 9·402124 | 20 178 | 10·597876 | 10·013413 | 20 11 | 9·986587 | 20 | 50 |
| 30 | 42 | 9·388961 | 21 176 | 10·611039 | 9·402390 | 21 187 | 10·597610 | 10·013429 | 21 11 | 9·986571 | 18 | 30 |
| 11 | 44 | 9·389211 | 22 184 | 10·610789 | 9·402656 | 22 196 | 10·597344 | 10·013445 | 22 12 | 9·986555 | 16 | 49 |
| 30 | 46 | 9·389461 | 23 192 | 10·610539 | 9·402922 | 23 205 | 10·597078 | 10·013461 | 23 12 | 9·986539 | 14 | 30 |
| 12 | 48 | 9·389711 | 24 201 | 10·610289 | 9·403187 | 24 214 | 10·596813 | 10·013477 | 24 13 | 9·986523 | 12 | 48 |
| 30 | 50 | 9·389960 | 25 209 | 10·610040 | 9·403453 | 25 222 | 10·596547 | 10·013493 | 25 13 | 9·986507 | 10 | 30 |
| 13 | 52 | 9·390210 | 26 218 | 10·609790 | 9·403718 | 26 231 | 10·596282 | 10·013509 | 26 14 | 9·986491 | 8 | 47 |
| 30 | 54 | 9·390459 | 27 227 | 10·609541 | 9·403983 | 27 240 | 10·596017 | 10·013525 | 27 14 | 9·986475 | 6 | 30 |
| 14 | 56 | 9·390708 | 28 236 | 10·609292 | 9·404249 | 28 249 | 10·595751 | 10·013541 | 28 15 | 9·986459 | 4 | 46 |
| 30 | 58 | 9·390957 | 29 244 | 10·609043 | 9·404514 | 29 258 | 10·595486 | 10·013557 | 29 15 | 9·986443 | 2 | 30 |
| 15 | **57** | 9·391206 | 30 251 | 10·608794 | 9·404778 | 30 267 | 10·595222 | 10·013573 | 30 16 | 9·986427 | **3** | 45 |
| 30 | 2 | 9·391454 | 1 8 | 10·608546 | 9·405043 | 1 9 | 10·594957 | 10·013589 | 1 1 | 9·986411 | 58 | 30 |
| 16 | 4 | 9·391703 | 2 16 | 10·608297 | 9·405308 | 2 17 | 10·594692 | 10·013605 | 2 1 | 9·986395 | 56 | 44 |
| 30 | 6 | 9·391951 | 3 25 | 10·608049 | 9·405572 | 3 26 | 10·594428 | 10·013621 | 3 2 | 9·986379 | 54 | 30 |
| 17 | 8 | 9·392199 | 4 33 | 10·607801 | 9·405836 | 4 35 | 10·594164 | 10·013637 | 4 2 | 9·986363 | 52 | 43 |
| 30 | 10 | 9·392447 | 5 41 | 10·607553 | 9·406100 | 5 44 | 10·593900 | 10·013653 | 5 3 | 9·986347 | 50 | 30 |
| 18 | 12 | 9·392695 | 6 49 | 10·607305 | 9·406364 | 6 52 | 10·593636 | 10·013669 | 6 3 | 9·986331 | 48 | 42 |
| 30 | 14 | 9·392943 | 7 57 | 10·607057 | 9·406628 | 7 61 | 10·593372 | 10·013685 | 7 4 | 9·986315 | 46 | 30 |
| 19 | 16 | 9·393191 | 8 66 | 10·606809 | 9·406892 | 8 70 | 10·593108 | 10·013701 | 8 4 | 9·986299 | 44 | 41 |
| 30 | 18 | 9·393438 | 9 74 | 10·606562 | 9·407155 | 9 79 | 10·592845 | 10·013718 | 9 5 | 9·986282 | 42 | 30 |
| 20 | 20 | 9·393685 | 10 82 | 10·606315 | 9·407419 | 10 87 | 10·592581 | 10·013734 | 10 5 | 9·986266 | 40 | 40 |
| 30 | 22 | 9·393932 | 11 90 | 10·606068 | 9·407682 | 11 96 | 10·592318 | 10·013750 | 11 6 | 9·986250 | 38 | 30 |
| 21 | 24 | 9·394179 | 12 98 | 10·605821 | 9·407945 | 12 105 | 10·592055 | 10·013766 | 12 6 | 9·986234 | 36 | 39 |
| 30 | 26 | 9·394426 | 13 106 | 10·605574 | 9·408208 | 13 114 | 10·591792 | 10·013782 | 13 7 | 9·986218 | 34 | 30 |
| 22 | 28 | 9·394673 | 14 114 | 10·605327 | 9·408471 | 14 122 | 10·591529 | 10·013798 | 14 8 | 9·986202 | 32 | 38 |
| 30 | 30 | 9·394919 | 15 123 | 10·605081 | 9·408734 | 15 131 | 10·591266 | 10·013814 | 15 8 | 9·986186 | 30 | 30 |
| 23 | 32 | 9·395166 | 16 132 | 10·604834 | 9·408996 | 16 140 | 10·591004 | 10·013831 | 16 9 | 9·986169 | 28 | 37 |
| 30 | 34 | 9·395412 | 17 140 | 10·604588 | 9·409259 | 17 149 | 10·590741 | 10·013847 | 17 9 | 9·986153 | 26 | 30 |
| 24 | 36 | 9·395658 | 18 148 | 10·604342 | 9·409521 | 18 157 | 10·590479 | 10·013863 | 18 10 | 9·986137 | 24 | 36 |
| 30 | 38 | 9·395904 | 19 156 | 10·604096 | 9·409783 | 19 166 | 10·590217 | 10·013879 | 19 10 | 9·986121 | 22 | 30 |
| 25 | 40 | 9·396150 | 20 164 | 10·603850 | 9·410045 | 20 175 | 10·589955 | 10·013896 | 20 11 | 9·986104 | 20 | 35 |
| 30 | 42 | 9·396395 | 21 172 | 10·603605 | 9·410307 | 21 184 | 10·589693 | 10·013912 | 21 11 | 9·986088 | 18 | 30 |
| 26 | 44 | 9·396641 | 22 180 | 10·603359 | 9·410569 | 22 192 | 10·589431 | 10·013928 | 22 12 | 9·986072 | 16 | 34 |
| 30 | 46 | 9·396886 | 23 189 | 10·603114 | 9·410831 | 23 201 | 10·589169 | 10·013944 | 23 12 | 9·986056 | 14 | 30 |
| 27 | 48 | 9·397132 | 24 197 | 10·602868 | 9·411092 | 24 210 | 10·588908 | 10·013961 | 24 13 | 9·986039 | 12 | 33 |
| 30 | 50 | 9·397377 | 25 205 | 10·602623 | 9·411353 | 25 219 | 10·588647 | 10·013977 | 25 13 | 9·986023 | 10 | 30 |
| 28 | 52 | 9·397621 | 26 213 | 10·602379 | 9·411615 | 26 227 | 10·588385 | 10·013993 | 26 14 | 9·986007 | 8 | 32 |
| 30 | 54 | 9·397866 | 27 221 | 10·602134 | 9·411876 | 27 236 | 10·588124 | 10·014009 | 27 15 | 9·985991 | 6 | 30 |
| 29 | 56 | 9·398111 | 28 229 | 10·601889 | 9·412137 | 28 245 | 10·587863 | 10·014026 | 28 15 | 9·985974 | 4 | 31 |
| 30 | 58 | 9·398355 | 29 237 | 10·601645 | 9·412397 | 29 254 | 10·587603 | 10·014042 | 29 16 | 9·985958 | 2 | 30 |
| 30 | **58** | 9·398600 | 30 246 | 10·601400 | 9·412658 | 30 262 | 10·587342 | 10·014058 | 30 16 | 9·985942 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

75° — 5h 2m

TABLE XXVI.—(*continued*).

## LOG. SINES, COSINES, &c.

0h 58m — 14°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30′ | 0 | 9·398600 | | 10·601400 | 9·412658 | | 10·587342 | 10·014058 | | 9·985942 | 2 | 30 |
| 30 | 2 | 9·398844 | 1″ 8 | 10·601156 | 9·412919 | 1″ 9 | 10·587081 | 10·014075 | 1″ 1 | 9·985925 | 58 | 30 |
| 31 | 4 | 9·399088 | 2 16 | 10·600912 | 9·413179 | 2 17 | 10·586821 | 10·014091 | 2 1 | 9·985909 | 56 | 29 |
| 30 | 6 | 9·399332 | 3 24 | 10·600668 | 9·413439 | 3 26 | 10·586561 | 10·014107 | 3 2 | 9·985893 | 54 | 30 |
| 32 | 8 | 9·399575 | 4 32 | 10·600425 | 9·413699 | 4 34 | 10·586301 | 10·014124 | 4 2 | 9·985876 | 52 | 28 |
| 30 | 10 | 9·399819 | 5 40 | 10·600181 | 9·413959 | 5 43 | 10·586041 | 10·014140 | 5 3 | 9·985860 | 50 | 30 |
| 33 | 12 | 9·400062 | 6 48 | 10·599938 | 9·414219 | 6 52 | 10·585781 | 10·014157 | 6 3 | 9·985843 | 48 | 27 |
| 30 | 14 | 9·400306 | 7 56 | 10·599694 | 9·414479 | 7 60 | 10·585521 | 10·014173 | 7 4 | 9·985827 | 46 | 30 |
| 34 | 16 | 9·400549 | 8 65 | 10·599451 | 9·414738 | 8 69 | 10·585262 | 10·014189 | 8 4 | 9·985811 | 44 | 26 |
| 30 | 18 | 9·400792 | 9 73 | 10·599208 | 9·414998 | 9 78 | 10·585002 | 10·014206 | 9 5 | 9·985794 | 42 | 30 |
| 35 | 20 | 9·401035 | 10 81 | 10·598965 | 9·415257 | 10 86 | 10·584743 | 10·014222 | 10 5 | 9·985778 | 40 | 25 |
| 30 | 22 | 9·401277 | 11 89 | 10·598723 | 9·415516 | 11 95 | 10·584484 | 10·014239 | 11 6 | 9·985761 | 38 | 30 |
| 36 | 24 | 9·401520 | 12 96 | 10·598480 | 9·415775 | 12 103 | 10·584225 | 10·014255 | 12 7 | 9·985745 | 36 | 24 |
| 30 | 26 | 9·401762 | 13 104 | 10·598238 | 9·416034 | 13 112 | 10·583966 | 10·014272 | 13 7 | 9·985728 | 34 | 30 |
| 37 | 28 | 9·402005 | 14 112 | 10·597995 | 9·416293 | 14 121 | 10·583707 | 10·014288 | 14 8 | 9·985712 | 32 | 23 |
| 30 | 30 | 9·402247 | 15 120 | 10·597753 | 9·416551 | 15 129 | 10·583449 | 10·014305 | 15 8 | 9·985695 | 30 | 30 |
| 38 | 32 | 9·402489 | 16 129 | 10·597511 | 9·416810 | 16 138 | 10·583190 | 10·014321 | 16 9 | 9·985679 | 28 | 22 |
| 30 | 34 | 9·402731 | 17 137 | 10·597269 | 9·417068 | 17 147 | 10·582932 | 10·014338 | 17 9 | 9·985662 | 26 | 30 |
| 39 | 36 | 9·402972 | 18 145 | 10·597028 | 9·417326 | 18 155 | 10·582674 | 10·014354 | 18 10 | 9·985646 | 24 | 21 |
| 30 | 38 | 9·403214 | 19 153 | 10·596786 | 9·417585 | 19 164 | 10·582415 | 10·014371 | 19 10 | 9·985629 | 22 | 30 |
| 40 | 40 | 9·403455 | 20 161 | 10·596545 | 9·417842 | 20 172 | 10·582158 | 10·014387 | 20 11 | 9·985613 | 20 | 20 |
| 30 | 42 | 9·403697 | 21 169 | 10·596303 | 9·418100 | 21 181 | 10·581900 | 10·014404 | 21 12 | 9·985596 | 18 | 30 |
| 41 | 44 | 9·403938 | 22 178 | 10·596062 | 9·418358 | 22 190 | 10·581642 | 10·014420 | 22 12 | 9·985580 | 16 | 19 |
| 30 | 46 | 9·404179 | 23 186 | 10·595821 | 9·418616 | 23 198 | 10·581384 | 10·014437 | 23 13 | 9·985563 | 14 | 30 |
| 42 | 48 | 9·404420 | 24 194 | 10·595580 | 9·418873 | 24 207 | 10·581127 | 10·014453 | 24 13 | 9·985547 | 12 | 18 |
| 30 | 50 | 9·404660 | 25 202 | 10·595340 | 9·419130 | 25 215 | 10·580870 | 10·014470 | 25 14 | 9·985530 | 10 | 30 |
| 43 | 52 | 9·404901 | 26 210 | 10·595099 | 9·419387 | 26 224 | 10·580613 | 10·014486 | 26 14 | 9·985514 | 8 | 17 |
| 30 | 54 | 9·405141 | 27 218 | 10·594859 | 9·419644 | 27 233 | 10·580356 | 10·014503 | 27 15 | 9·985497 | 6 | 30 |
| 44 | 56 | 9·405382 | 28 226 | 10·594618 | 9·419901 | 28 241 | 10·580099 | 10·014520 | 28 15 | 9·985480 | 4 | 16 |
| 30 | 58 | 9·405622 | 29 234 | 10·594378 | 9·420158 | 29 250 | 10·579842 | 10·014536 | 29 16 | 9·985464 | 2 | 30 |
| 45 | **59** | 9·405862 | 30 242 | 10·594138 | 9·420415 | 30 259 | 10·579585 | 10·014553 | 30 16 | 9·985447 | **1** | 15 |
| 30 | 2 | 9·406102 | 1 8 | 10·593898 | 9·420671 | 1 8 | 10·579329 | 10·014570 | 1 1 | 9·985430 | 58 | 30 |
| 46 | 4 | 9·406341 | 2 16 | 10·593659 | 9·420927 | 2 17 | 10·579073 | 10·014586 | 2 1 | 9·985414 | 56 | 14 |
| 30 | 6 | 9·406581 | 3 24 | 10·593419 | 9·421184 | 3 25 | 10·578816 | 10·014603 | 3 2 | 9·985397 | 54 | 30 |
| 47 | 8 | 9·406820 | 4 32 | 10·593180 | 9·421440 | 4 34 | 10·578560 | 10·014619 | 4 2 | 9·985381 | 52 | 13 |
| 30 | 10 | 9·407060 | 5 40 | 10·592940 | 9·421696 | 5 42 | 10·578304 | 10·014636 | 5 3 | 9·985364 | 50 | 30 |
| 48 | 12 | 9·407299 | 6 48 | 10·592701 | 9·421952 | 6 51 | 10·578048 | 10·014653 | 6 3 | 9·985347 | 48 | 12 |
| 30 | 14 | 9·407538 | 7 55 | 10·592462 | 9·422207 | 7 59 | 10·577793 | 10·014670 | 7 4 | 9·985330 | 46 | 30 |
| 49 | 16 | 9·407777 | 8 63 | 10·592223 | 9·422463 | 8 68 | 10·577537 | 10·014686 | 8 4 | 9·985314 | 44 | 11 |
| 30 | 18 | 9·408015 | 9 71 | 10·591985 | 9·422718 | 9 76 | 10·577282 | 10·014703 | 9 5 | 9·985297 | 42 | 30 |
| 50 | 20 | 9·408254 | 10 79 | 10·591746 | 9·422974 | 10 85 | 10·577026 | 10·014720 | 10 6 | 9·985280 | 40 | 10 |
| 30 | 22 | 9·408492 | 11 87 | 10·591508 | 9·423229 | 11 93 | 10·576771 | 10·014736 | 11 6 | 9·985264 | 38 | 30 |
| 51 | 24 | 9·408731 | 12 95 | 10·591269 | 9·423484 | 12 102 | 10·576516 | 10·014753 | 12 7 | 9·985247 | 36 | 9 |
| 30 | 26 | 9·408969 | 13 103 | 10·591031 | 9·423739 | 13 110 | 10·576261 | 10·014770 | 13 7 | 9·985230 | 34 | 30 |
| 52 | 28 | 9·409207 | 14 111 | 10·590793 | 9·423993 | 14 119 | 10·576007 | 10·014787 | 14 8 | 9·985213 | 32 | 8 |
| 30 | 30 | 9·409445 | 15 118 | 10·590555 | 9·424248 | 15 127 | 10·575752 | 10·014803 | 15 8 | 9·985197 | 30 | 30 |
| 53 | 32 | 9·409682 | 16 126 | 10·590318 | 9·424503 | 16 136 | 10·575497 | 10·014820 | 16 9 | 9·985180 | 28 | 7 |
| 30 | 34 | 9·409920 | 17 134 | 10·590080 | 9·424757 | 17 144 | 10·575243 | 10·014837 | 17 10 | 9·985163 | 26 | 30 |
| 54 | 36 | 9·410157 | 18 142 | 10·589843 | 9·425011 | 18 153 | 10·574989 | 10·014854 | 18 10 | 9·985146 | 24 | 6 |
| 30 | 38 | 9·410395 | 19 150 | 10·589605 | 9·425265 | 19 161 | 10·574735 | 10·014871 | 19 11 | 9·985129 | 22 | 30 |
| 55 | 40 | 9·410632 | 20 158 | 10·589368 | 9·425519 | 20 170 | 10·574481 | 10·014887 | 20 11 | 9·985113 | 20 | 5 |
| 30 | 42 | 9·410869 | 21 166 | 10·589131 | 9·425773 | 21 178 | 10·574227 | 10·014904 | 21 12 | 9·985096 | 18 | 30 |
| 56 | 44 | 9·411106 | 22 174 | 10·588894 | 9·426027 | 22 187 | 10·573973 | 10·014921 | 22 12 | 9·985079 | 16 | 4 |
| 30 | 46 | 9·411343 | 23 182 | 10·588657 | 9·426281 | 23 195 | 10·573719 | 10·014938 | 23 13 | 9·985062 | 14 | 30 |
| 57 | 48 | 9·411579 | 24 190 | 10·588421 | 9·426534 | 24 204 | 10·573466 | 10·014955 | 24 13 | 9·985045 | 12 | 3 |
| 30 | 50 | 9·411816 | 25 198 | 10·588184 | 9·426787 | 25 212 | 10·573212 | 10·014972 | 25 14 | 9·985028 | 10 | 30 |
| 58 | 52 | 9·412052 | 26 206 | 10·587948 | 9·427041 | 26 220 | 10·572959 | 10·014989 | 26 15 | 9·985011 | 8 | 2 |
| 30 | 54 | 9·412288 | 27 214 | 10·587712 | 9·427294 | 27 229 | 10·572706 | 10·015005 | 27 15 | 9·984995 | 6 | 30 |
| 59 | 56 | 9·412524 | 28 222 | 10·587476 | 9·427547 | 28 237 | 10·572453 | 10·015022 | 28 16 | 9·984978 | 4 | 1 |
| 30 | 58 | 9·412760 | 29 230 | 10·587240 | 9·427800 | 29 246 | 10·572200 | 10·015039 | 29 16 | 9·984961 | 2 | 30 |
| 60 | **60** | 9·412996 | 30 238 | 10·587004 | 9·428052 | 30 254 | 10·571948 | 10·015056 | 30 17 | 9·984944 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

75° — 5h 0m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$1^h\ 0^m$ 15°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·412996 | | 10·587004 | 9·428052 | | 10·571948 | 10·015056 | | 9·984944 | 60 | 60 |
| 30 | 2 | 9·413232 | 1″ 8 | 10·586768 | 9·428305 | 1″ 8 | 10·571695 | 10·015073 | 1″ 1 | 9·984927 | 58 | 30 |
| 1 | 4 | 9·413467 | 2 16 | 10·586533 | 9·428558 | 2 17 | 10·571442 | 10·015090 | 2 1 | 9·984910 | 56 | 59 |
| 30 | 6 | 9·413703 | 3 23 | 10·586297 | 9·428810 | 3 25 | 10·571190 | 10·015107 | 3 2 | 9·984893 | 54 | 30 |
| 2 | 8 | 9·413938 | 4 31 | 10·586062 | 9·429062 | 4 33 | 10·570938 | 10·015124 | 4 2 | 9·984876 | 52 | 58 |
| 30 | 10 | 9·414173 | 5 39 | 10·585827 | 9·429314 | 5 42 | 10·570686 | 10·015141 | 5 3 | 9·984859 | 50 | 30 |
| 3 | 12 | 9·414408 | 6 47 | 10·585592 | 9·429566 | 6 50 | 10·570434 | 10·015158 | 6 3 | 9·984842 | 48 | 57 |
| 30 | 14 | 9·414643 | 7 55 | 10·585357 | 9·429818 | 7 59 | 10·570182 | 10·015175 | 7 4 | 9·984825 | 46 | 30 |
| 4 | 16 | 9·414878 | 8 62 | 10·585122 | 9·430070 | 8 67 | 10·569930 | 10·015192 | 8 5 | 9·984808 | 44 | 56 |
| 30 | 18 | 9·415112 | 9 70 | 10·584888 | 9·430321 | 9 75 | 10·569679 | 10·015209 | 9 5 | 9·984791 | 42 | 30 |
| 5 | 20 | 9·415347 | 10 78 | 10·584653 | 9·430573 | 10 84 | 10·569427 | 10·015226 | 10 6 | 9·984774 | 40 | 55 |
| 30 | 22 | 9·415581 | 11 86 | 10·584419 | 9·430824 | 11 92 | 10·569176 | 10·015243 | 11 6 | 9·984757 | 38 | 30 |
| 6 | 24 | 9·415815 | 12 94 | 10·584185 | 9·431075 | 12 100 | 10·568925 | 10·015260 | 12 7 | 9·984740 | 36 | 54 |
| 30 | 26 | 9·416049 | 13 101 | 10·583951 | 9·431326 | 13 109 | 10·568674 | 10·015277 | 13 7 | 9·984723 | 34 | 30 |
| 7 | 28 | 9·416283 | 14 109 | 10·583717 | 9·431577 | 14 117 | 10·568423 | 10·015294 | 14 8 | 9·984706 | 32 | 53 |
| 30 | 30 | 9·416517 | 15 117 | 10·583483 | 9·431828 | 15 125 | 10·568172 | 10·015311 | 15 9 | 9·984689 | 30 | 30 |
| 8 | 32 | 9·416751 | 16 125 | 10·583249 | 9·432079 | 16 134 | 10·567921 | 10·015328 | 16 9 | 9·984672 | 28 | 52 |
| 30 | 34 | 9·416984 | 17 133 | 10·583016 | 9·432329 | 17 142 | 10·567671 | 10·015345 | 17 10 | 9·984655 | 26 | 30 |
| 9 | 36 | 9·417217 | 18 140 | 10·582783 | 9·432580 | 18 150 | 10·567420 | 10·015362 | 18 10 | 9·984638 | 24 | 51 |
| 30 | 38 | 9·417451 | 19 148 | 10·582549 | 9·432830 | 19 159 | 10·567170 | 10·015380 | 19 11 | 9·984620 | 22 | 30 |
| 10 | 40 | 9·417684 | 20 156 | 10·582316 | 9·433080 | 20 167 | 10·566920 | 10·015397 | 20 11 | 9·984603 | 20 | 50 |
| 30 | 42 | 9·417917 | 21 164 | 10·582083 | 9·433331 | 21 176 | 10·566669 | 10·015414 | 21 12 | 9·984586 | 18 | 30 |
| 11 | 44 | 9·418150 | 22 171 | 10·581850 | 9·433580 | 22 184 | 10·566420 | 10·015431 | 22 13 | 9·984569 | 16 | 49 |
| 30 | 46 | 9·418382 | 23 179 | 10·581618 | 9·433830 | 23 192 | 10·566170 | 10·015448 | 23 13 | 9·984552 | 14 | 30 |
| 12 | 48 | 9·418615 | 24 187 | 10·581385 | 9·434080 | 24 201 | 10·565920 | 10·015465 | 24 14 | 9·984535 | 12 | 48 |
| 30 | 50 | 9·418847 | 25 195 | 10·581153 | 9·434330 | 25 209 | 10·565670 | 10·015482 | 25 14 | 9·984518 | 10 | 30 |
| 13 | 52 | 9·419079 | 26 203 | 10·580921 | 9·434579 | 26 217 | 10·565421 | 10·015500 | 26 15 | 9·984500 | 8 | 47 |
| 30 | 54 | 9·419312 | 27 210 | 10·580688 | 9·434828 | 27 226 | 10·565172 | 10·015517 | 27 15 | 9·984483 | 6 | 30 |
| 14 | 56 | 9·419544 | 28 218 | 10·580456 | 9·435078 | 28 234 | 10·564922 | 10·015534 | 28 16 | 9·984466 | 4 | 46 |
| 30 | 58 | 9·419776 | 29 226 | 10·580224 | 9·435327 | 29 242 | 10·564673 | 10·015551 | 29 17 | 9·984449 | 2 | 30 |
| 15 | 1 | 9·420007 | 30 234 | 10·579993 | 9·435576 | 30 251 | 10·564424 | 10·015568 | 30 17 | 9·984432 | 59 | 45 |
| 30 | 2 | 9·420239 | 1 8 | 10·579761 | 9·435825 | 1 8 | 10·564175 | 10·015586 | 1 1 | 9·984414 | 58 | 30 |
| 16 | 4 | 9·420470 | 2 15 | 10·579530 | 9·436073 | 2 16 | 10·563927 | 10·015603 | 2 1 | 9·984397 | 56 | 44 |
| 30 | 6 | 9·420702 | 3 23 | 10·579298 | 9·436322 | 3 25 | 10·563678 | 10·015620 | 3 2 | 9·984380 | 54 | 30 |
| 17 | 8 | 9·420933 | 4 31 | 10·579067 | 9·436570 | 4 33 | 10·563430 | 10·015637 | 4 2 | 9·984363 | 52 | 43 |
| 30 | 10 | 9·421164 | 5 38 | 10·578836 | 9·436819 | 5 41 | 10·563181 | 10·015655 | 5 3 | 9·984345 | 50 | 30 |
| 18 | 12 | 9·421395 | 6 46 | 10·578605 | 9·437067 | 6 49 | 10·562933 | 10·015672 | 6 3 | 9·984328 | 48 | 42 |
| 30 | 14 | 9·421626 | 7 54 | 10·578374 | 9·437315 | 7 58 | 10·562685 | 10·015689 | 7 4 | 9·984311 | 46 | 30 |
| 19 | 16 | 9·421857 | 8 61 | 10·578143 | 9·437563 | 8 66 | 10·562437 | 10·015706 | 8 5 | 9·984294 | 44 | 41 |
| 30 | 18 | 9·422087 | 9 69 | 10·577913 | 9·437811 | 9 74 | 10·562189 | 10·015724 | 9 5 | 9·984276 | 42 | 30 |
| 20 | 20 | 9·422318 | 10 77 | 10·577682 | 9·438059 | 10 82 | 10·561941 | 10·015741 | 10 6 | 9·984259 | 40 | 40 |
| 30 | 22 | 9·422548 | 11 85 | 10·577452 | 9·438306 | 11 91 | 10·561694 | 10·015758 | 11 6 | 9·984242 | 38 | 30 |
| 21 | 24 | 9·422778 | 12 92 | 10·577222 | 9·438554 | 12 99 | 10·561446 | 10·015776 | 12 7 | 9·984224 | 36 | 39 |
| 30 | 26 | 9·423008 | 13 100 | 10·576992 | 9·438801 | 13 107 | 10·561199 | 10·015793 | 13 8 | 9·984207 | 34 | 30 |
| 22 | 28 | 9·423238 | 14 108 | 10·576762 | 9·439048 | 14 115 | 10·560952 | 10·015810 | 14 8 | 9·984190 | 32 | 38 |
| 30 | 30 | 9·423468 | 15 115 | 10·576532 | 9·439296 | 15 123 | 10·560704 | 10·015828 | 15 9 | 9·984172 | 30 | 30 |
| 23 | 32 | 9·423697 | 16 123 | 10·576303 | 9·439543 | 16 132 | 10·560457 | 10·015845 | 16 9 | 9·984155 | 28 | 37 |
| 30 | 34 | 9·423927 | 17 131 | 10·576073 | 9·439790 | 17 140 | 10·560210 | 10·015863 | 17 10 | 9·984137 | 26 | 30 |
| 24 | 36 | 9·424156 | 18 138 | 10·575844 | 9·440036 | 18 148 | 10·559964 | 10·015880 | 18 10 | 9·984120 | 24 | 36 |
| 30 | 38 | 9·424386 | 19 146 | 10·575614 | 9·440283 | 19 156 | 10·559717 | 10·015897 | 19 11 | 9·984103 | 22 | 30 |
| 25 | 40 | 9·424615 | 20 153 | 10·575385 | 9·440529 | 20 165 | 10·559471 | 10·015915 | 20 12 | 9·984085 | 20 | 35 |
| 30 | 42 | 9·424844 | 21 161 | 10·575156 | 9·440776 | 21 173 | 10·559224 | 10·015932 | 21 12 | 9·984068 | 18 | 30 |
| 26 | 44 | 9·425073 | 22 169 | 10·574927 | 9·441022 | 22 181 | 10·558978 | 10·015950 | 22 13 | 9·984050 | 16 | 34 |
| 30 | 46 | 9·425301 | 23 176 | 10·574699 | 9·441268 | 23 189 | 10·558732 | 10·015967 | 23 13 | 9·984033 | 14 | 30 |
| 27 | 48 | 9·425530 | 24 184 | 10·574470 | 9·441514 | 24 198 | 10·558486 | 10·015985 | 24 14 | 9·984015 | 12 | 33 |
| 30 | 50 | 9·425758 | 25 192 | 10·574242 | 9·441760 | 25 206 | 10·558240 | 10·016002 | 25 14 | 9·983998 | 10 | 30 |
| 28 | 52 | 9·425987 | 26 199 | 10·574013 | 9·442006 | 26 214 | 10·557994 | 10·016019 | 26 15 | 9·983981 | 8 | 32 |
| 30 | 54 | 9·426215 | 27 207 | 10·573785 | 9·442252 | 27 222 | 10·557748 | 10·016037 | 27 16 | 9·983963 | 6 | 30 |
| 29 | 56 | 9·426443 | 28 215 | 10·573557 | 9·442497 | 28 230 | 10·557503 | 10·016054 | 28 16 | 9·983946 | 4 | 31 |
| 30 | 58 | 9·426671 | 29 222 | 10·573329 | 9·442743 | 29 239 | 10·557257 | 10·016072 | 29 17 | 9·983928 | 2 | 30 |
| 30 | 2 | 9·426899 | 30 230 | 10·573101 | 9·442988 | 30 247 | 10·557012 | 10·016089 | 30 17 | 9·983911 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

74° $4^h.58^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

1h 2m — 15°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·426899 | | 10·573101 | 9·442988 | | 10·557012 | 10·016089 | | 9·983911 | 58 | 30 |
| 30 | 2 | 9·427127 | 1″ 8 | 10·572873 | 9·443234 | 1″ 8 | 10·556766 | 10·016107 | 1″ 1 | 9·983893 | 58 | 30 |
| 31 | 4 | 9·427354 | 2 15 | 10·572646 | 9·443479 | 2 16 | 10·556521 | 10·016125 | 2 1 | 9·983875 | 56 | 29 |
| 30 | 6 | 9·427582 | 3 23 | 10·572418 | 9·443724 | 3 24 | 10·556276 | 10·016142 | 3 2 | 9·983858 | 54 | 30 |
| 32 | 8 | 9·427809 | 4 30 | 10·572191 | 9·443968 | 4 32 | 10·556032 | 10·016160 | 4 2 | 9·983840 | 52 | 28 |
| 30 | 10 | 9·428036 | 5 38 | 10·571964 | 9·444213 | 6 41 | 10·555787 | 10·016177 | 5 3 | 9·983823 | 50 | 30 |
| 33 | 12 | 9·428263 | 6 45 | 10·571737 | 9·444458 | 6 49 | 10·555542 | 10·016195 | 6 4 | 9·983805 | 48 | 27 |
| 30 | 14 | 9·428490 | 7 53 | 10·571510 | 9·444702 | 7 57 | 10·555298 | 10·016212 | 7 4 | 9·983788 | 46 | 30 |
| 34 | 16 | 9·428717 | 8 60 | 10·571283 | 9·444947 | 8 65 | 10·555053 | 10·016230 | 8 5 | 9·983770 | 44 | 26 |
| 30 | 18 | 9·428944 | 9 68 | 10·571056 | 9·445191 | 9 73 | 10·554809 | 10·016248 | 9 5 | 9·983752 | 42 | 30 |
| 35 | 20 | 9·429170 | 10 75 | 10·570830 | 9·445435 | 10 81 | 10·554565 | 10·016265 | 10 6 | 9·983735 | 40 | 25 |
| 30 | 22 | 9·429397 | 11 83 | 10·570603 | 9·445679 | 11 89 | 10·554321 | 10·016283 | 11 6 | 9·983717 | 38 | 30 |
| 36 | 24 | 9·429623 | 12 90 | 10·570377 | 9·445923 | 12 97 | 10·554077 | 10·016300 | 12 7 | 9·983700 | 36 | 24 |
| 30 | 26 | 9·429849 | 13 98 | 10·570151 | 9·446167 | 13 106 | 10·553833 | 10·016318 | 13 8 | 9·983682 | 34 | 30 |
| 37 | 28 | 9·430075 | 14 105 | 10·569925 | 9·446411 | 14 114 | 10·553589 | 10·016336 | 14 8 | 9·983664 | 32 | 23 |
| 30 | 30 | 9·430301 | 15 113 | 10·569699 | 9·446654 | 15 122 | 10·553346 | 10·016353 | 15 9 | 9·983647 | 30 | 30 |
| 38 | 32 | 9·430527 | 16 120 | 10·569473 | 9·446898 | 16 130 | 10·553102 | 10·016371 | 16 9 | 9·983629 | 28 | 22 |
| 30 | 34 | 9·430752 | 17 128 | 10·569248 | 9·447141 | 17 138 | 10·552859 | 10·016389 | 17 10 | 9·983611 | 26 | 30 |
| 39 | 36 | 9·430978 | 18 135 | 10·569022 | 9·447384 | 18 146 | 10·552616 | 10·016406 | 18 11 | 9·983594 | 24 | 21 |
| 30 | 38 | 9·431203 | 19 143 | 10·568797 | 9·447627 | 19 154 | 10·552373 | 10·016424 | 19 11 | 9·983576 | 22 | 30 |
| 40 | 40 | 9·431429 | 20 151 | 10·568571 | 9·447870 | 20 162 | 10·552130 | 10·016442 | 20 12 | 9·983558 | 20 | 20 |
| 30 | 42 | 9·431654 | 21 158 | 10·568346 | 9·448113 | 21 171 | 10·551887 | 10·016460 | 21 12 | 9·983540 | 18 | 30 |
| 41 | 44 | 9·431879 | 22 166 | 10·568121 | 9·448356 | 22 179 | 10·551644 | 10·016477 | 22 13 | 9·983523 | 16 | 19 |
| 30 | 46 | 9·432104 | 23 173 | 10·567896 | 9·448599 | 23 187 | 10·551401 | 10·016495 | 23 14 | 9·983505 | 14 | 30 |
| 42 | 48 | 9·432329 | 24 181 | 10·567671 | 9·448841 | 24 195 | 10·551159 | 10·016513 | 24 14 | 9·983487 | 12 | 18 |
| 30 | 50 | 9·432553 | 25 188 | 10·567447 | 9·449084 | 25 203 | 10·550916 | 10·016531 | 25 15 | 9·983469 | 10 | 30 |
| 43 | 52 | 9·432778 | 26 196 | 10·567222 | 9·449326 | 26 211 | 10·550674 | 10·016548 | 26 15 | 9·983452 | 8 | 17 |
| 30 | 54 | 9·433002 | 27 203 | 10·566998 | 9·449568 | 27 219 | 10·550432 | 10·016566 | 27 16 | 9·983434 | 6 | 30 |
| 44 | 56 | 9·433226 | 28 210 | 10·566774 | 9·449810 | 28 227 | 10·550190 | 10·016584 | 28 17 | 9·983416 | 4 | 16 |
| 30 | 58 | 9·433451 | 29 217 | 10·566549 | 9·450052 | 29 235 | 10·549948 | 10·016602 | 29 17 | 9·983398 | 2 | 30 |
| 45 | **3** | 9·433675 | 30 226 | 10·566325 | 9·450294 | 30 244 | 10·549706 | 10·016619 | 30 18 | 9·983381 | **57** | 15 |
| 30 | 2 | 9·433898 | 1 7 | 10·566102 | 9·450536 | 1 8 | 10·549464 | 10·016637 | 1 1 | 9·983363 | 58 | 30 |
| 46 | 4 | 9·434122 | 2 15 | 10·565878 | 9·450777 | 2 16 | 10·549223 | 10·016655 | 2 1 | 9·983345 | 56 | 14 |
| 30 | 6 | 9·434346 | 3 22 | 10·565654 | 9·451019 | 3 24 | 10·548981 | 10·016673 | 3 2 | 9·983327 | 54 | 30 |
| 47 | 8 | 9·434569 | 4 30 | 10·565431 | 9·451260 | 4 32 | 10·548740 | 10·016691 | 4 2 | 9·983309 | 52 | 3 |
| 30 | 10 | 9·434793 | 5 37 | 10·565207 | 9·451502 | 5 40 | 10·548498 | 10·016709 | 5 3 | 9·983291 | 50 | 30 |
| 48 | 12 | 9·435016 | 6 44 | 10·564984 | 9·451743 | 6 48 | 10·548257 | 10·016727 | 6 4 | 9·983273 | 48 | 12 |
| 30 | 14 | 9·435239 | 7 52 | 10·564761 | 9·451984 | 7 56 | 10·548016 | 10·016744 | 7 4 | 9·983256 | 46 | 30 |
| 49 | 16 | 9·435462 | 8 59 | 10·564538 | 9·452225 | 8 64 | 10·547775 | 10·016762 | 8 5 | 9·983238 | 44 | 11 |
| 30 | 18 | 9·435685 | 9 67 | 10·564315 | 9·452465 | 9 72 | 10·547535 | 10·016780 | 9 5 | 9·983220 | 42 | 30 |
| 50 | 20 | 9·435908 | 10 74 | 10·564092 | 9·452706 | 10 80 | 10·547294 | 10·016798 | 10 6 | 9·983202 | 40 | 10 |
| 30 | 22 | 9·436131 | 11 82 | 10·563869 | 9·452947 | 11 88 | 10·547053 | 10·016816 | 11 7 | 9·983184 | 38 | 30 |
| 51 | 24 | 9·436353 | 12 89 | 10·563647 | 9·453187 | 12 96 | 10·546813 | 10·016834 | 12 7 | 9·983166 | 36 | 9 |
| 30 | 26 | 9·436576 | 13 97 | 10·563424 | 9·453428 | 13 104 | 10·546572 | 10·016852 | 13 8 | 9·983148 | 34 | 30 |
| 52 | 28 | 9·436798 | 14 104 | 10·563202 | 9·453668 | 14 112 | 10·546332 | 10·016870 | 14 8 | 9·983130 | 32 | 8 |
| 30 | 30 | 9·437020 | 15 111 | 10·562980 | 9·453908 | 15 120 | 10·546092 | 10·016888 | 15 9 | 9·983112 | 30 | 30 |
| 53 | 32 | 9·437242 | 16 118 | 10·562758 | 9·454148 | 16 128 | 10·545852 | 10·016906 | 16 10 | 9·983094 | 28 | 7 |
| 30 | 34 | 9·437464 | 17 126 | 10·562536 | 9·454388 | 17 136 | 10·545612 | 10·016924 | 17 10 | 9·983076 | 26 | 30 |
| 54 | 36 | 9·437686 | 18 133 | 10·562314 | 9·454628 | 18 144 | 10·545372 | 10·016942 | 18 11 | 9·983058 | 24 | 6 |
| 30 | 38 | 9·437908 | 19 141 | 10·562092 | 9·454867 | 19 152 | 10·545133 | 10·016960 | 19 11 | 9·983040 | 22 | 30 |
| 55 | 40 | 9·438129 | 20 148 | 10·561871 | 9·455107 | 20 160 | 10·544893 | 10·016978 | 20 12 | 9·983022 | 20 | 5 |
| 30 | 42 | 9·438351 | 21 156 | 10·561649 | 9·455346 | 21 168 | 10·544654 | 10·016996 | 21 13 | 9·983004 | 18 | 30 |
| 56 | 44 | 9·438572 | 22 163 | 10·561428 | 9·455586 | 22 176 | 10·544414 | 10·017014 | 22 13 | 9·982986 | 16 | 4 |
| 30 | 46 | 9·438793 | 23 171 | 10·561207 | 9·455825 | 23 184 | 10·544175 | 10·017032 | 23 14 | 9·982968 | 14 | 30 |
| 57 | 48 | 9·439014 | 24 178 | 10·560986 | 9·456064 | 24 192 | 10·543936 | 10·017050 | 24 14 | 9·982950 | 12 | 3 |
| 30 | 50 | 9·439235 | 25 185 | 10·560765 | 9·456303 | 25 200 | 10·543697 | 10·017068 | 25 15 | 9·982932 | 10 | 30 |
| 58 | 52 | 9·439456 | 26 192 | 10·560544 | 9·456542 | 26 208 | 10·543458 | 10·017086 | 26 16 | 9·982914 | 8 | 2 |
| 30 | 54 | 9·439677 | 27 200 | 10·560323 | 9·456781 | 27 216 | 10·543219 | 10·017104 | 27 16 | 9·982896 | 6 | 30 |
| 59 | 56 | 9·439897 | 28 207 | 10·560103 | 9·457019 | 28 224 | 10·542981 | 10·017122 | 28 17 | 9·982878 | 4 | 1 |
| 30 | 58 | 9·440118 | 29 215 | 10·559882 | 9·457258 | 29 232 | 10·542742 | 10·017140 | 29 17 | 9·982860 | 2 | 30 |
| 60 | **4** | 9·440338 | 30 222 | 10·559662 | 9·457496 | 30 240 | 10·542504 | 10·017158 | 30 18 | 9·982842 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

74° — 4h 56m

TABLE XXVI.—(*continued*).

LOG. SINES. COSINES. &c.

| 1h 4m | | | | | 16° | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 0 | 0 | 9·440338 | | 10·559662 | 9·457496 | | 10·542504 | 10·017158 | | 9·982842 | 56 | 60 |
| 30 | 2 | 9·440558 | 1″ 7 | 10·559441 | 9·457735 | 1″ 8 | 10·542265 | 10·017176 | 1″ 1 | 9·982824 | 58 | 30 |
| 1 | 4 | 9·440778 | 2 15 | 10·559222 | 9·457973 | 2 16 | 10·542027 | 10·017195 | 2 1 | 9·982805 | 56 | 59 |
| 30 | 6 | 9·440998 | 3 22 | 10·559002 | 9·458211 | 3 24 | 10·541789 | 10·017213 | 3 2 | 9·982787 | 54 | 30 |
| 2 | 8 | 9·441218 | 4 29 | 10·558782 | 9·458449 | 4 32 | 10·541551 | 10·017231 | 4 2 | 9·982769 | 52 | 58 |
| 30 | 10 | 9·441438 | 5 36 | 10·558562 | 9·458687 | 5 39 | 10·541313 | 10·017249 | 5 3 | 9·982751 | 50 | 30 |
| 3 | 12 | 9·441658 | 6 44 | 10·558342 | 9·458925 | 6 47 | 10·541075 | 10·017267 | 6 4 | 9·982733 | 48 | 57 |
| 30 | 14 | 9·441877 | 7 51 | 10·558123 | 9·459163 | 7 55 | 10·540837 | 10·017285 | 7 4 | 9·982715 | 46 | 30 |
| 4 | 16 | 9·442096 | 8 58 | 10·557904 | 9·459400 | 8 63 | 10·540600 | 10·017304 | 8 5 | 9·982696 | 44 | 56 |
| 30 | 18 | 9·442316 | 9 65 | 10·557684 | 9·459638 | 9 71 | 10·540362 | 10·017322 | 9 5 | 9·982678 | 42 | 30 |
| 5 | 20 | 9·442535 | 10 73 | 10·557465 | 9·459875 | 10 79 | 10·540125 | 10·017340 | 10 6 | 9·982660 | 40 | 55 |
| 30 | 22 | 9·442754 | 11 80 | 10·557246 | 9·460112 | 11 87 | 10·539888 | 10·017358 | 11 7 | 9·982642 | 38 | 30 |
| 6 | 24 | 9·442973 | 12 87 | 10·557027 | 9·460349 | 12 95 | 10·539651 | 10·017376 | 12 7 | 9·982624 | 36 | 54 |
| 30 | 26 | 9·443192 | 13 95 | 10·556808 | 9·460586 | 13 103 | 10·539414 | 10·017395 | 13 8 | 9·982605 | 34 | 30 |
| 7 | 28 | 9·443410 | 14 102 | 10·556590 | 9·460823 | 14 110 | 10·539177 | 10·017413 | 14 9 | 9·982587 | 32 | 53 |
| 30 | 30 | 9·443629 | 15 109 | 10·556371 | 9·461060 | 15 118 | 10·538940 | 10·017431 | 15 9 | 9·982569 | 30 | 30 |
| 8 | 32 | 9·443847 | 16 116 | 10·556153 | 9·461297 | 16 126 | 10·538703 | 10·017449 | 16 10 | 9·982551 | 28 | 52 |
| 30 | 34 | 9·444066 | 17 124 | 10·555934 | 9·461533 | 17 134 | 10·538467 | 10·017468 | 17 10 | 9·982532 | 26 | 30 |
| 9 | 36 | 9·444284 | 18 131 | 10·555716 | 9·461770 | 18 142 | 10·538230 | 10·017486 | 18 11 | 9·982514 | 24 | 51 |
| 30 | 38 | 9·444502 | 19 138 | 10·555498 | 9·462006 | 19 150 | 10·537994 | 10·017504 | 19 12 | 9·982496 | 22 | 30 |
| 10 | 40 | 9·444720 | 20 146 | 10·555280 | 9·462242 | 20 158 | 10·537758 | 10·017523 | 20 12 | 9·982477 | 20 | 50 |
| 30 | 42 | 9·444938 | 21 153 | 10·555062 | 9·462478 | 21 166 | 10·537522 | 10·017541 | 21 13 | 9·982459 | 18 | 30 |
| 11 | 44 | 9·445155 | 22 160 | 10·554845 | 9·462715 | 22 174 | 10·537286 | 10·017559 | 22 13 | 9·982441 | 16 | 49 |
| 30 | 46 | 9·445373 | 23 167 | 10·554627 | 9·462950 | 23 181 | 10·537050 | 10·017578 | 23 14 | 9·982422 | 14 | 30 |
| 12 | 48 | 9·445590 | 24 175 | 10·554410 | 9·463186 | 24 189 | 10·536814 | 10·017596 | 24 15 | 9·982404 | 12 | 48 |
| 30 | 50 | 9·445808 | 25 182 | 10·554192 | 9·463422 | 25 197 | 10·536578 | 10·017614 | 25 15 | 9·982386 | 10 | 30 |
| 13 | 52 | 9·446025 | 26 189 | 10·553975 | 9·463658 | 26 205 | 10·536342 | 10·017633 | 26 16 | 9·982367 | 8 | 47 |
| 30 | 54 | 9·446242 | 27 196 | 10·553758 | 9·463893 | 27 213 | 10·536107 | 10·017651 | 27 16 | 9·982349 | 6 | 30 |
| 14 | 56 | 9·446459 | 28 204 | 10·553541 | 9·464128 | 28 221 | 10·535872 | 10·017669 | 28 17 | 9·982331 | 4 | 46 |
| 30 | 58 | 9·446676 | 29 211 | 10·553324 | 9·464364 | 29 229 | 10·535636 | 10·017688 | 29 18 | 9·982312 | 2 | 30 |
| 15 | 5 | 9·446893 | 30 218 | 10·553107 | 9·464599 | 30 237 | 10·535401 | 10·017706 | 30 18 | 9·982294 | 55 | 45 |
| 30 | 2 | 9·447109 | 1 7 | 10·552891 | 9·464834 | 1 8 | 10·535166 | 10·017725 | 1 1 | 9·982275 | 58 | 30 |
| 16 | 4 | 9·447326 | 2 14 | 10·552674 | 9·465069 | 2 16 | 10·534931 | 10·017743 | 2 1 | 9·982257 | 56 | 44 |
| 30 | 6 | 9·447542 | 3 22 | 10·552458 | 9·465304 | 3 23 | 10·534696 | 10·017761 | 3 2 | 9·982239 | 54 | 30 |
| 17 | 8 | 9·447759 | 4 29 | 10·552241 | 9·465539 | 4 31 | 10·534461 | 10·017780 | 4 2 | 9·982220 | 52 | 43 |
| 30 | 10 | 9·447975 | 5 36 | 10·552025 | 9·465773 | 5 39 | 10·534227 | 10·017798 | 5 3 | 9·982202 | 50 | 30 |
| 18 | 12 | 9·448191 | 6 43 | 10·551809 | 9·466008 | 6 47 | 10·533992 | 10·017817 | 6 4 | 9·982183 | 48 | 42 |
| 30 | 14 | 9·448407 | 7 50 | 10·551593 | 9·466242 | 7 54 | 10·533758 | 10·017835 | 7 4 | 9·982165 | 46 | 30 |
| 19 | 16 | 9·448623 | 8 57 | 10·551377 | 9·466477 | 8 62 | 10·533523 | 10·017854 | 8 5 | 9·982146 | 44 | 41 |
| 30 | 18 | 9·448838 | 9 64 | 10·551162 | 9·466711 | 9 70 | 10·533289 | 10·017872 | 9 6 | 9·982128 | 42 | 30 |
| 20 | 20 | 9·449054 | 10 72 | 10·550946 | 9·466945 | 10 78 | 10·533055 | 10·017891 | 10 6 | 9·982109 | 40 | 40 |
| 30 | 22 | 9·449269 | 11 79 | 10·550731 | 9·467179 | 11 86 | 10·532821 | 10·017909 | 11 7 | 9·982091 | 38 | 30 |
| 21 | 24 | 9·449485 | 12 86 | 10·550515 | 9·467413 | 12 93 | 10·532587 | 10·017928 | 12 7 | 9·982072 | 36 | 39 |
| 30 | 26 | 9·449700 | 13 93 | 10·550300 | 9·467647 | 13 101 | 10·532353 | 10·017946 | 13 8 | 9·982054 | 34 | 30 |
| 22 | 28 | 9·449915 | 14 100 | 10·550085 | 9·467880 | 14 109 | 10·532120 | 10·017965 | 14 9 | 9·982035 | 32 | 38 |
| 30 | 30 | 9·450130 | 15 107 | 10·549870 | 9·468114 | 15 117 | 10·531886 | 10·017984 | 15 9 | 9·982016 | 30 | 30 |
| 23 | 32 | 9·450345 | 16 114 | 10·549655 | 9·468347 | 16 124 | 10·531653 | 10·018002 | 16 10 | 9·981998 | 28 | 37 |
| 30 | 34 | 9·450560 | 17 122 | 10·549440 | 9·468581 | 17 132 | 10·531419 | 10·018021 | 17 11 | 9·981979 | 26 | 30 |
| 24 | 36 | 9·450775 | 18 129 | 10·549225 | 9·468814 | 18 140 | 10·531186 | 10·018039 | 18 11 | 9·981961 | 24 | 36 |
| 30 | 38 | 9·450989 | 19 136 | 10·549011 | 9·469047 | 19 148 | 10·530953 | 10·018058 | 19 12 | 9·981942 | 22 | 30 |
| 25 | 40 | 9·451204 | 20 143 | 10·548796 | 9·469280 | 20 156 | 10·530720 | 10·018076 | 20 12 | 9·981924 | 20 | 35 |
| 30 | 42 | 9·451418 | 21 150 | 10·548582 | 9·469513 | 21 163 | 10·530487 | 10·018095 | 21 13 | 9·981905 | 18 | 30 |
| 26 | 44 | 9·451632 | 22 157 | 10·548368 | 9·469746 | 22 171 | 10·530254 | 10·018114 | 22 14 | 9·981886 | 16 | 34 |
| 30 | 46 | 9·451846 | 23 165 | 10·548154 | 9·469979 | 23 179 | 10·530021 | 10·018132 | 23 14 | 9·981868 | 14 | 30 |
| 27 | 48 | 9·452060 | 24 172 | 10·547940 | 9·470211 | 24 187 | 10·529789 | 10·018151 | 24 15 | 9·981849 | 12 | 33 |
| 30 | 50 | 9·452274 | 25 179 | 10·547726 | 9·470444 | 25 194 | 10·529556 | 10·018170 | 25 16 | 9·981830 | 10 | 30 |
| 28 | 52 | 9·452488 | 26 186 | 10·547512 | 9·470676 | 26 202 | 10·529324 | 10·018188 | 26 16 | 9·981812 | 8 | 32 |
| 30 | 54 | 9·452702 | 27 193 | 10·547298 | 9·470909 | 27 210 | 10·529091 | 10·018207 | 27 17 | 9·981793 | 6 | 30 |
| 29 | 56 | 9·452915 | 28 200 | 10·547085 | 9·471141 | 28 218 | 10·528859 | 10·018226 | 28 17 | 9·981774 | 4 | 31 |
| 30 | 58 | 9·453129 | 29 208 | 10·546871 | 9·471373 | 29 226 | 10·528627 | 10·018244 | 29 18 | 9·981756 | 2 | 30 |
| 30 | 6 | 9·453342 | 30 215 | 10·546658 | 9·471605 | 30 233 | 10·528395 | 10·018263 | 30 19 | 9·981737 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | 73° | | | | | 4h 54m | | |

TABLE XXVI.—(*continued*).

## LOG. SINES, COSINES, &c.

1h 6m — 16°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·453342 | | 10·546658 | 9·471605 | | 10·528395 | 10·018263 | | 9·981737 | 54 | 30 |
| 30 | 2 | 9·453555 | 1″ 7 | 10·546445 | 9·471837 | 1″ 8 | 10·528163 | 10·018282 | 1″ 1 | 9·981718 | 58 | 30 |
| 31 | 4 | 9·453768 | 2 14 | 10·546232 | 9·472069 | 2 15 | 10·527931 | 10·018300 | 2 1 | 9·981700 | 56 | 29 |
| 30 | 6 | 9·453981 | 3 21 | 10·546019 | 9·472300 | 3 23 | 10·527700 | 10·018319 | 3 2 | 9·981681 | 54 | 30 |
| 32 | 8 | 9·454194 | 4 28 | 10·545806 | 9·472532 | 4 31 | 10·527468 | 10·018338 | 4 3 | 9·981662 | 52 | 28 |
| 30 | 10 | 9·454407 | 5 35 | 10·545593 | 9·472763 | 5 38 | 10·527237 | 10·018357 | 5 3 | 9·981643 | 50 | 30 |
| 33 | 12 | 9·454619 | 6 42 | 10·545381 | 9·472995 | 6 46 | 10·527005 | 10·018375 | 6 4 | 9·981625 | 48 | 27 |
| 30 | 14 | 9·454832 | 7 49 | 10·545168 | 9·473226 | 7 54 | 10·526774 | 10·018394 | 7 4 | 9·981606 | 46 | 30 |
| 34 | 16 | 9·455044 | 8 56 | 10·544956 | 9·473457 | 8 61 | 10·526543 | 10·018413 | 8 5 | 9·981587 | 44 | 26 |
| 30 | 18 | 9·455256 | 9 63 | 10·544744 | 9·473688 | 9 69 | 10·526312 | 10·018432 | 9 6 | 9·981568 | 42 | 30 |
| 35 | 20 | 9·455469 | 10 70 | 10·544531 | 9·473919 | 10 77 | 10·526081 | 10·018451 | 10 6 | 9·981549 | 40 | 25 |
| 30 | 22 | 9·455681 | 11 78 | 10·544319 | 9·474150 | 11 84 | 10·525850 | 10·018469 | 11 7 | 9·981531 | 38 | 30 |
| 36 | 24 | 9·455893 | 12 85 | 10·544107 | 9·474381 | 12 92 | 10·525619 | 10·018488 | 12 8 | 9·981512 | 36 | 24 |
| 30 | 26 | 9·456104 | 13 92 | 10·543896 | 9·474612 | 13 100 | 10·525388 | 10·018507 | 13 8 | 9·981493 | 34 | 30 |
| 37 | 28 | 9·456316 | 14 99 | 10·543684 | 9·474842 | 14 108 | 10·525158 | 10·018526 | 14 9 | 9·981474 | 32 | 23 |
| 30 | 30 | 9·456528 | 15 106 | 10·543472 | 9·475073 | 15 115 | 10·524927 | 10·018545 | 15 9 | 9·981455 | 30 | 30 |
| 38 | 32 | 9·456739 | 16 113 | 10·543261 | 9·475303 | 16 123 | 10·524697 | 10·018564 | 16 10 | 9·981436 | 28 | 22 |
| 30 | 34 | 9·456951 | 17 120 | 10·543049 | 9·475533 | 17 131 | 10·524467 | 10·018583 | 17 11 | 9·981417 | 26 | 30 |
| 39 | 36 | 9·457162 | 18 127 | 10·542838 | 9·475763 | 18 138 | 10·524237 | 10·018601 | 18 11 | 9·981399 | 24 | 21 |
| 30 | 38 | 9·457373 | 19 134 | 10·542627 | 9·475993 | 19 146 | 10·524007 | 10·018620 | 19 12 | 9·981380 | 22 | 30 |
| 40 | 40 | 9·457584 | 20 141 | 10·542416 | 9·476223 | 20 154 | 10·523777 | 10·018639 | 20 13 | 9·981361 | 20 | 20 |
| 30 | 42 | 9·457795 | 21 148 | 10·542205 | 9·476453 | 21 161 | 10·523547 | 10·018658 | 21 13 | 9·981342 | 18 | 30 |
| 41 | 44 | 9·458006 | 22 155 | 10·541994 | 9·476683 | 22 169 | 10·523317 | 10·018677 | 22 14 | 9·981323 | 16 | 19 |
| 30 | 46 | 9·458217 | 23 162 | 10·541783 | 9·476913 | 23 177 | 10·523087 | 10·018696 | 23 14 | 9·981304 | 14 | 30 |
| 42 | 48 | 9·458427 | 24 169 | 10·541573 | 9·477142 | 24 184 | 10·522858 | 10·018715 | 24 15 | 9·981285 | 12 | 18 |
| 30 | 50 | 9·458638 | 25 176 | 10·541362 | 9·477372 | 25 192 | 10·522628 | 10·018734 | 25 16 | 9·981266 | 10 | 30 |
| 43 | 52 | 9·458848 | 26 183 | 10·541152 | 9·477601 | 26 200 | 10·522399 | 10·018753 | 26 16 | 9·981247 | 8 | 17 |
| 30 | 54 | 9·459058 | 27 190 | 10·540942 | 9·477830 | 27 207 | 10·522170 | 10·018772 | 27 17 | 9·981228 | 6 | 30 |
| 44 | 56 | 9·459268 | 28 197 | 10·540732 | 9·478059 | 28 215 | 10·521941 | 10·018791 | 28 18 | 9·981209 | 4 | 16 |
| 30 | 58 | 9·459478 | 29 204 | 10·540522 | 9·478288 | 29 223 | 10·521712 | 10·018810 | 29 18 | 9·981190 | 2 | 30 |
| 45 | **7** | 9·459688 | 30 211 | 10·540312 | 9·478517 | 30 230 | 10·521483 | 10·018829 | 30 19 | 9·981171 | **53** | 15 |
| 30 | 2 | 9·459898 | 1 7 | 10·540102 | 9·478746 | 1 8 | 10·521254 | 10·018848 | 1 1 | 9·981152 | 58 | 30 |
| 46 | 4 | 9·460108 | 2 14 | 10·539892 | 9·478975 | 2 15 | 10·521025 | 10·018867 | 2 1 | 9·981133 | 56 | 14 |
| 30 | 6 | 9·460317 | 3 21 | 10·539683 | 9·479203 | 3 23 | 10·520797 | 10·018886 | 3 2 | 9·981114 | 54 | 30 |
| 47 | 8 | 9·460527 | 4 28 | 10·539473 | 9·479432 | 4 30 | 10·520568 | 10·018905 | 4 3 | 9·981095 | 52 | 13 |
| 30 | 10 | 9·460736 | 5 35 | 10·539264 | 9·479660 | 5 38 | 10·520340 | 10·018924 | 5 3 | 9·981076 | 50 | 30 |
| 48 | 12 | 9·460946 | 6 42 | 10·539054 | 9·479889 | 6 45 | 10·520111 | 10·018943 | 6 4 | 9·981057 | 48 | 12 |
| 30 | 14 | 9·461155 | 7 49 | 10·538845 | 9·480117 | 7 53 | 10·519883 | 10·018962 | 7 4 | 9·981038 | 46 | 30 |
| 49 | 16 | 9·461364 | 8 56 | 10·538636 | 9·480345 | 8 61 | 10·519655 | 10·018981 | 8 5 | 9·981019 | 44 | 11 |
| 30 | 18 | 9·461573 | 9 62 | 10·538427 | 9·480573 | 9 68 | 10·519427 | 10·019000 | 9 6 | 9·981000 | 42 | 30 |
| 50 | 20 | 9·461782 | 10 69 | 10·538218 | 9·480801 | 10 76 | 10·519199 | 10·019019 | 10 6 | 9·980981 | 40 | 10 |
| 30 | 22 | 9·461990 | 11 76 | 10·538010 | 9·481029 | 11 83 | 10·518971 | 10·019039 | 11 7 | 9·980901 | 38 | 30 |
| 51 | 24 | 9·462199 | 12 83 | 10·537801 | 9·481257 | 12 91 | 10·518743 | 10·019058 | 12 8 | 9·980942 | 36 | 9 |
| 30 | 26 | 9·462407 | 13 90 | 10·537593 | 9·481484 | 13 99 | 10·518516 | 10·019077 | 13 8 | 9·980923 | 34 | 30 |
| 52 | 28 | 9·462616 | 14 97 | 10·537384 | 9·481712 | 14 106 | 10·518288 | 10·019090 | 14 9 | 9·980904 | 32 | 8 |
| 30 | 30 | 9·462824 | 15 104 | 10·537176 | 9·481939 | 15 114 | 10·518061 | 10·019115 | 15 10 | 9·980885 | 30 | 30 |
| 53 | 32 | 9·463032 | 16 111 | 10·536968 | 9·482167 | 16 121 | 10·517833 | 10·019134 | 16 10 | 9·980866 | 28 | 7 |
| 30 | 34 | 9·463240 | 17 118 | 10·536760 | 9·482394 | 17 129 | 10·517606 | 10·019153 | 17 11 | 9·980847 | 26 | 30 |
| 54 | 36 | 9·463448 | 18 125 | 10·536552 | 9·482621 | 18 136 | 10·517379 | 10·019173 | 18 12 | 9·980827 | 24 | 6 |
| 30 | 38 | 9·463656 | 19 132 | 10·536344 | 9·482848 | 19 144 | 10·517152 | 10·019192 | 19 12 | 9·980808 | 22 | 30 |
| 55 | 40 | 9·463864 | 20 139 | 10·536136 | 9·483075 | 20 152 | 10·516925 | 10·019211 | 20 13 | 9·980789 | 20 | 5 |
| 30 | 42 | 9·464072 | 21 146 | 10·535928 | 9·483302 | 21 159 | 10·516698 | 10·019230 | 21 13 | 9·980770 | 18 | 30 |
| 56 | 44 | 9·464279 | 22 153 | 10·535721 | 9·483529 | 22 167 | 10·516471 | 10·019250 | 22 14 | 9·980750 | 16 | 4 |
| 30 | 46 | 9·464486 | 23 160 | 10·535514 | 9·483755 | 23 174 | 10·516245 | 10·019269 | 23 15 | 9·980731 | 14 | 30 |
| 57 | 48 | 9·464694 | 24 167 | 10·535306 | 9·483982 | 24 182 | 10·516018 | 10·019288 | 24 15 | 9·980712 | 12 | 3 |
| 30 | 50 | 9·464901 | 25 174 | 10·535099 | 9·484208 | 25 189 | 10·515792 | 10·019307 | 25 16 | 9·980693 | 10 | 30 |
| 58 | 52 | 9·465108 | 26 180 | 10·534892 | 9·484435 | 26 197 | 10·515565 | 10·019327 | 26 17 | 9·980673 | 8 | 2 |
| 30 | 54 | 9·465315 | 27 187 | 10·534685 | 9·484661 | 27 205 | 10·515339 | 10·019346 | 27 17 | 9·980654 | 6 | 30 |
| 59 | 56 | 9·465522 | 28 194 | 10·534478 | 9·484887 | 28 212 | 10·515113 | 10·019365 | 28 18 | 9·980635 | 4 | 1 |
| 30 | 58 | 9·465729 | 29 201 | 10·534271 | 9·485113 | 29 220 | 10·514887 | 10·019384 | 29 19 | 9·980616 | 2 | 30 |
| 60 | **8** | 9·465935 | 30 208 | 10·534065 | 9·485339 | 30 227 | 10·514661 | 10·019404 | 30 19 | 9·980596 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

73° — 4h 52m

TABLE XXVI.—(*continued.*)

LOG. SINES, COSINES, &c.

| 1h 8m | | | | | 17° | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 0 | 0 | 9·465935 | | 10·534065 | 9·485339 | | 10·514661 | 10·019404 | | 9·980596 | **52** | 60 |
| 30 | 2 | 9·466142 | 1″ 7 | 10·533858 | 9·485565 | 1″ 7 | 10·514435 | 10·019423 | 1″ 1 | 9·980577 | 58 | 30 |
| 1 | 4 | 9·466348 | 2 14 | 10·533652 | 9·485791 | 2 15 | 10·514209 | 10·019442 | 2 1 | 9·980558 | 56 | 59 |
| 30 | 6 | 9·466555 | 3 20 | 10·533445 | 9·486016 | 3 22 | 10·513984 | 10·019462 | 3 2 | 9·980538 | 54 | 30 |
| 2 | 8 | 9·466761 | 4 27 | 10·533239 | 9·486242 | 4 30 | 10·513758 | 10·019481 | 4 3 | 9·980519 | 52 | 58 |
| 30 | 10 | 9·466967 | 5 34 | 10·533033 | 9·486467 | 5 37 | 10·513533 | 10·019500 | 5 3 | 9·980500 | 50 | 30 |
| 3 | 12 | 9·467173 | 6 41 | 10·532827 | 9·486693 | 6 45 | 10·513307 | 10·019520 | 6 4 | 9·980480 | 48 | 57 |
| 30 | 14 | 9·467379 | 7 48 | 10·532621 | 9·486918 | 7 52 | 10·513082 | 10·019539 | 7 5 | 9·980461 | 46 | 30 |
| 4 | 16 | 9·467585 | 8 55 | 10·532415 | 9·487143 | 8 60 | 10·512857 | 10·019558 | 8 5 | 9·980442 | 44 | 56 |
| 30 | 18 | 9·467790 | 9 61 | 10·532210 | 9·487368 | 9 67 | 10·512632 | 10·019578 | 9 6 | 9·980422 | 42 | 30 |
| 5 | 20 | 9·467996 | 10 68 | 10·532004 | 9·487593 | 10 75 | 10·512407 | 10·019597 | 10 6 | 9·980403 | 40 | 55 |
| 30 | 22 | 9·468202 | 11 75 | 10·531798 | 9·487818 | 11 82 | 10·512182 | 10·019617 | 11 7 | 9·980383 | 38 | 30 |
| 6 | 24 | 9·468407 | 12 82 | 10·531593 | 9·488043 | 12 90 | 10·511957 | 10·019636 | 12 8 | 9·980364 | 36 | 54 |
| 30 | 26 | 9·468612 | 13 89 | 10·531388 | 9·488268 | 13 97 | 10·511732 | 10·019656 | 13 8 | 9·980344 | 34 | 30 |
| 7 | 28 | 9·468817 | 14 96 | 10·531183 | 9·488492 | 14 105 | 10·511508 | 10·019675 | 14 9 | 9·980325 | 32 | 53 |
| 30 | 30 | 9·469022 | 15 102 | 10·530978 | 9·488717 | 15 112 | 10·511283 | 10·019694 | 15 10 | 9·980306 | 30 | 30 |
| 8 | 32 | 9·469227 | 16 109 | 10·530773 | 9·488941 | 16 120 | 10·511059 | 10·019714 | 16 10 | 9·980286 | 28 | 52 |
| 30 | 34 | 9·469432 | 17 116 | 10·530568 | 9·489166 | 17 127 | 10·510834 | 10·019733 | 17 11 | 9·980267 | 26 | 30 |
| 9 | 36 | 9·469637 | 18 123 | 10·530363 | 9·489390 | 18 135 | 10·510610 | 10·019753 | 18 12 | 9·980247 | 24 | 51 |
| 30 | 38 | 9·469842 | 19 130 | 10·530158 | 9·489614 | 19 142 | 10·510386 | 10·019772 | 19 12 | 9·980228 | 22 | 30 |
| 10 | 40 | 9·470046 | 20 137 | 10·529954 | 9·489838 | 20 150 | 10·510162 | 10·019792 | 20 13 | 9·980208 | 20 | 50 |
| 30 | 42 | 9·470251 | 21 143 | 10·529749 | 9·490062 | 21 157 | 10·509938 | 10·019811 | 21 14 | 9·980189 | 18 | 30 |
| 11 | 44 | 9·470455 | 22 150 | 10·529545 | 9·490286 | 22 165 | 10·509714 | 10·019831 | 22 14 | 9·980169 | 16 | 49 |
| 30 | 46 | 9·470659 | 23 157 | 10·529341 | 9·490510 | 23 172 | 10·509490 | 10·019851 | 23 15 | 9·980149 | 14 | 30 |
| 12 | 48 | 9·470863 | 24 164 | 10·529137 | 9·490733 | 24 180 | 10·509267 | 10·019870 | 24 16 | 9·980130 | 12 | 48 |
| 30 | 50 | 9·471067 | 25 171 | 10·528933 | 9·490957 | 25 187 | 10·509043 | 10·019890 | 25 16 | 9·980110 | 10 | 30 |
| 13 | 52 | 9·471271 | 26 178 | 10·528729 | 9·491180 | 26 194 | 10·508820 | 10·019909 | 26 17 | 9·980091 | 8 | 47 |
| 30 | 54 | 9·471475 | 27 184 | 10·528525 | 9·491404 | 27 202 | 10·508596 | 10·019929 | 27 18 | 9·980071 | 6 | 30 |
| 14 | 56 | 9·471679 | 28 191 | 10·528321 | 9·491627 | 28 209 | 10·508373 | 10·019948 | 28 18 | 9·980052 | 4 | 46 |
| 30 | 58 | 9·471882 | 29 198 | 10·528118 | 9·491850 | 29 217 | 10·508150 | 10·019968 | 29 19 | 9·980032 | 2 | 30 |
| 15 | **9** | 9·472086 | 30 205 | 10·527914 | 9·492073 | 30 224 | 10·507927 | 10·019988 | 30 19 | 9·980012 | **51** | 45 |
| 30 | 2 | 9·472289 | 1 7 | 10·527711 | 9·492296 | 1 7 | 10·507704 | 10·020007 | 1 1 | 9·979993 | 58 | 30 |
| 16 | 4 | 9·472492 | 2 13 | 10·527508 | 9·492519 | 2 15 | 10·507481 | 10·020027 | 2 1 | 9·979973 | 56 | 44 |
| 30 | 6 | 9·472695 | 3 20 | 10·527305 | 9·492742 | 3 22 | 10·507258 | 10·020046 | 3 2 | 9·979954 | 54 | 30 |
| 17 | 8 | 9·472898 | 4 27 | 10·527102 | 9·492965 | 4 30 | 10·507035 | 10·020066 | 4 3 | 9·979934 | 52 | 43 |
| 30 | 10 | 9·473101 | 5 34 | 10·526899 | 9·493187 | 5 37 | 10·506813 | 10·020086 | 5 3 | 9·979914 | 50 | 30 |
| 18 | 12 | 9·473304 | 6 40 | 10·526696 | 9·493410 | 6 44 | 10·506590 | 10·020105 | 6 4 | 9·979895 | 48 | 42 |
| 30 | 14 | 9·473507 | 7 47 | 10·526493 | 9·493632 | 7 52 | 10·506368 | 10·020125 | 7 5 | 9·979875 | 46 | 30 |
| 19 | 16 | 9·473710 | 8 54 | 10·526290 | 9·493854 | 8 59 | 10·506146 | 10·020145 | 8 5 | 9·979855 | 44 | 41 |
| 30 | 18 | 9·473912 | 9 61 | 10·526088 | 9·494077 | 9 66 | 10·505923 | 10·020164 | 9 6 | 9·979836 | 42 | 30 |
| 20 | 20 | 9·474115 | 10 67 | 10·525885 | 9·494299 | 10 74 | 10·505701 | 10·020184 | 10 7 | 9·979816 | 40 | 40 |
| 30 | 22 | 9·474317 | 11 74 | 10·525683 | 9·494521 | 11 81 | 10·505479 | 10·020204 | 11 7 | 9·979796 | 38 | 30 |
| 21 | 24 | 9·474519 | 12 81 | 10·525481 | 9·494743 | 12 89 | 10·505257 | 10·020224 | 12 8 | 9·979776 | 36 | 39 |
| 30 | 26 | 9·474721 | 13 88 | 10·525279 | 9·494965 | 13 96 | 10·505035 | 10·020243 | 13 9 | 9·979757 | 34 | 30 |
| 22 | 28 | 9·474923 | 14 94 | 10·525077 | 9·495186 | 14 103 | 10·504814 | 10·020263 | 14 9 | 9·979737 | 32 | 38 |
| 30 | 30 | 9·475125 | 15 101 | 10·524875 | 9·495408 | 15 111 | 10·504592 | 10·020283 | 15 10 | 9·979717 | 30 | 30 |
| 23 | 32 | 9·475327 | 16 108 | 10·524673 | 9·495630 | 16 118 | 10·504370 | 10·020303 | 16 11 | 9·979697 | 28 | 37 |
| 30 | 34 | 9·475529 | 17 115 | 10·524471 | 9·495851 | 17 126 | 10·504149 | 10·020322 | 17 11 | 9·979678 | 26 | 30 |
| 24 | 36 | 9·475730 | 18 122 | 10·524270 | 9·496073 | 18 133 | 10·503927 | 10·020342 | 18 12 | 9·979658 | 24 | 36 |
| 30 | 38 | 9·475932 | 19 128 | 10·524068 | 9·496294 | 19 140 | 10·503706 | 10·020362 | 19 13 | 9·979638 | 22 | 30 |
| 25 | 40 | 9·476133 | 20 135 | 10·523867 | 9·496515 | 20 148 | 10·503485 | 10·020382 | 20 13 | 9·979618 | 20 | 35 |
| 30 | 42 | 9·476335 | 21 142 | 10·523665 | 9·496736 | 21 155 | 10·503264 | 10·020402 | 21 14 | 9·979598 | 18 | 30 |
| 26 | 44 | 9·476536 | 22 149 | 10·523464 | 9·496957 | 22 163 | 10·503043 | 10·020421 | 22 15 | 9·979579 | 16 | 34 |
| 30 | 46 | 9·476737 | 23 155 | 10·523263 | 9·497178 | 23 170 | 10·502822 | 10·020441 | 23 15 | 9·979559 | 14 | 30 |
| 27 | 48 | 9·476938 | 24 161 | 10·523062 | 9·497399 | 24 177 | 10·502601 | 10·020461 | 24 16 | 9·979539 | 12 | 33 |
| 30 | 50 | 9·477139 | 25 168 | 10·522861 | 9·497620 | 25 185 | 10·502380 | 10·020481 | 25 16 | 9·979519 | 10 | 30 |
| 28 | 52 | 9·477340 | 26 175 | 10·522660 | 9·497841 | 26 192 | 10·502159 | 10·020501 | 26 17 | 9·979499 | 8 | 32 |
| 30 | 54 | 9·477540 | 27 181 | 10·522460 | 9·498061 | 27 200 | 10·501939 | 10·020521 | 27 18 | 9·979479 | 6 | 30 |
| 29 | 56 | 9·477741 | 28 188 | 10·522259 | 9·498282 | 28 207 | 10·501718 | 10·020541 | 28 18 | 9·979459 | 4 | 31 |
| 30 | 58 | 9·477941 | 29 195 | 10·522059 | 9·498502 | 29 214 | 10·501498 | 10·020561 | 29 19 | 9·979439 | 2 | 30 |
| 30 | **10** | 9·478142 | 30 202 | 10·521858 | 9·498722 | 30 222 | 10·501278 | 10·020580 | 30 20 | 9·979420 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | 72° | | | | | 4h 50m | | |

## TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

1h 10m — 17°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·478142 | | 10·521858 | 9·498722 | | 10·501278 | 10·020580 | | 9·979420 | 50 | 30 |
| 30 | 2 | 9·478342 | 1″ 7 | 10·521658 | 9·498943 | 1″ 7 | 10·501057 | 10·020600 | 1″ 1 | 9·979400 | 58 | 30 |
| 31 | 4 | 9·478542 | 2 13 | 10·521458 | 9·499163 | 2 15 | 10·500837 | 10·020620 | 2 1 | 9·979380 | 56 | 29 |
| 30 | 6 | 9·478742 | 3 20 | 10·521258 | 9·499383 | 3 22 | 10·500617 | 10·020640 | 3 2 | 9·979360 | 54 | 30 |
| 32 | 8 | 9·478942 | 4 26 | 10·521058 | 9·499603 | 4 29 | 10·500397 | 10·020660 | 4 3 | 9·979340 | 52 | 28 |
| 30 | 10 | 9·479142 | 5 33 | 10·520858 | 9·499822 | 5 36 | 10·500178 | 10·020680 | 5 3 | 9·979320 | 50 | 30 |
| 33 | 12 | 9·479342 | 6 40 | 10·520658 | 9·500042 | 6 44 | 10·499958 | 10·020700 | 6 4 | 9·979300 | 48 | 27 |
| 30 | 14 | 9·479542 | 7 46 | 10·520458 | 9·500262 | 7 51 | 10·499738 | 10·020720 | 7 5 | 9·979280 | 46 | 30 |
| 34 | 16 | 9·479741 | 8 53 | 10·520259 | 9·500481 | 8 58 | 10·499519 | 10·020740 | 8 5 | 9·979260 | 44 | 26 |
| 30 | 18 | 9·479941 | 9 60 | 10·520059 | 9·500701 | 9 66 | 10·499299 | 10·020760 | 9 6 | 9·979240 | 42 | 30 |
| 35 | 20 | 9·480140 | 10 66 | 10·519860 | 9·500920 | 10 73 | 10·499080 | 10·020780 | 10 7 | 9·979220 | 40 | 25 |
| 30 | 22 | 9·480339 | 11 73 | 10·519661 | 9·501140 | 11 80 | 10·498860 | 10·020800 | 11 7 | 9·979200 | 38 | 30 |
| 36 | 24 | 9·480539 | 12 80 | 10·519461 | 9·501359 | 12 88 | 10·498641 | 10·020820 | 12 8 | 9·979180 | 36 | 24 |
| 30 | 26 | 9·480738 | 13 86 | 10·519262 | 9·501578 | 13 95 | 10·498422 | 10·020840 | 13 9 | 9·979160 | 34 | 30 |
| 37 | 28 | 9·480937 | 14 93 | 10·519063 | 9·501797 | 14 102 | 10·498203 | 10·020860 | 14 9 | 9·979140 | 32 | 23 |
| 30 | 30 | 9·481135 | 15 99 | 10·518865 | 9·502016 | 15 109 | 10·497984 | 10·020880 | 15 10 | 9·979120 | 30 | 30 |
| 38 | 32 | 9·481334 | 16 106 | 10·518666 | 9·502235 | 16 117 | 10·497765 | 10·020900 | 16 11 | 9·979100 | 28 | 22 |
| 30 | 34 | 9·481533 | 17 113 | 10·518467 | 9·502453 | 17 124 | 10·497547 | 10·020921 | 17 11 | 9·979079 | 26 | 30 |
| 39 | 36 | 9·481731 | 18 119 | 10·518269 | 9·502672 | 18 131 | 10·497328 | 10·020941 | 18 12 | 9·979059 | 24 | 21 |
| 30 | 38 | 9·481930 | 19 126 | 10·518070 | 9·502891 | 19 139 | 10·497109 | 10·020961 | 19 13 | 9·979039 | 22 | 30 |
| 40 | 40 | 9·482128 | 20 132 | 10·517872 | 9·503109 | 20 146 | 10·496891 | 10·020981 | 20 13 | 9·979019 | 20 | 20 |
| 30 | 42 | 9·482327 | 21 139 | 10·517673 | 9·503328 | 21 153 | 10·496672 | 10·021001 | 21 14 | 9·978999 | 18 | 30 |
| 41 | 44 | 9·482525 | 22 146 | 10·517475 | 9·503546 | 22 161 | 10·496454 | 10·021021 | 22 15 | 9·978979 | 16 | 19 |
| 30 | 46 | 9·482723 | 23 152 | 10·517277 | 9·503764 | 23 168 | 10·496236 | 10·021041 | 23 15 | 9·978959 | 14 | 30 |
| 42 | 48 | 9·482921 | 24 159 | 10·517079 | 9·503982 | 24 175 | 10·496018 | 10·021061 | 24 16 | 9·978939 | 12 | 18 |
| 30 | 50 | 9·483119 | 25 166 | 10·516881 | 9·504200 | 25 182 | 10·495800 | 10·021082 | 25 17 | 9·978918 | 10 | 30 |
| 43 | 52 | 9·483316 | 26 172 | 10·516684 | 9·504418 | 26 190 | 10·495582 | 10·021102 | 26 17 | 9·978898 | 8 | 17 |
| 30 | 54 | 9·483514 | 27 179 | 10·516486 | 9·504636 | 27 197 | 10·495364 | 10·021122 | 27 18 | 9·978878 | 6 | 30 |
| 44 | 56 | 9·483712 | 28 186 | 10·516288 | 9·504854 | 28 204 | 10·495146 | 10·021142 | 28 19 | 9·978858 | 4 | 16 |
| 30 | 58 | 9·483909 | 29 192 | 10·516091 | 9·505072 | 29 212 | 10·494928 | 10·021162 | 29 19 | 9·978838 | 2 | 30 |
| 45 | **11** | 9·484107 | 30 199 | 10·515893 | 9·505289 | 30 219 | 10·494711 | 10·021183 | 30 20 | 9·978817 | **49** | 15 |
| 30 | 2 | 9·484304 | 1 7 | 10·515696 | 9·505507 | 1 7 | 10·494493 | 10·021203 | 1 1 | 9·978797 | 58 | 30 |
| 46 | 4 | 9·484501 | 2 13 | 10·515499 | 9·505724 | 2 14 | 10·494276 | 10·021223 | 2 1 | 9·978777 | 56 | 14 |
| 30 | 6 | 9·484698 | 3 20 | 10·515302 | 9·505941 | 3 22 | 10·494059 | 10·021243 | 3 2 | 9·978757 | 54 | 30 |
| 47 | 8 | 9·484895 | 4 26 | 10·515105 | 9·506159 | 4 29 | 10·493841 | 10·021263 | 4 3 | 9·978737 | 52 | 13 |
| 30 | 10 | 9·485092 | 5 33 | 10·514908 | 9·506376 | 5 36 | 10·493624 | 10·021284 | 5 3 | 9·978716 | 50 | 30 |
| 48 | 12 | 9·485289 | 6 39 | 10·514711 | 9·506593 | 6 43 | 10·493407 | 10·021304 | 6 4 | 9·978696 | 48 | 12 |
| 30 | 14 | 9·485485 | 7 46 | 10·514515 | 9·506810 | 7 50 | 10·493190 | 10·021324 | 7 5 | 9·978676 | 46 | 30 |
| 49 | 16 | 9·485682 | 8 52 | 10·514318 | 9·507027 | 8 58 | 10·492973 | 10·021345 | 8 5 | 9·978655 | 44 | 11 |
| 30 | 18 | 9·485879 | 9 59 | 10·514121 | 9·507243 | 9 65 | 10·492757 | 10·021365 | 9 6 | 9·978635 | 42 | 30 |
| 50 | 20 | 9·486075 | 10 65 | 10·513925 | 9·507460 | 10 72 | 10·492540 | 10·021385 | 10 7 | 9·978615 | 40 | 10 |
| 30 | 22 | 9·486271 | 11 72 | 10·513729 | 9·507677 | 11 79 | 10·492323 | 10·021406 | 11 7 | 9·978594 | 38 | 30 |
| 51 | 24 | 9·486467 | 12 78 | 10·513533 | 9·507893 | 12 87 | 10·492107 | 10·021426 | 12 8 | 9·978574 | 36 | 9 |
| 30 | 26 | 9·486664 | 13 85 | 10·513336 | 9·508110 | 13 94 | 10·491890 | 10·021446 | 13 9 | 9·978554 | 34 | 30 |
| 52 | 28 | 9·486860 | 14 91 | 10·513140 | 9·508326 | 14 101 | 10·491674 | 10·021467 | 14 10 | 9·978533 | 32 | 8 |
| 30 | 30 | 9·487055 | 15 98 | 10·512945 | 9·508542 | 15 108 | 10·491458 | 10·021487 | 15 10 | 9·978513 | 30 | 30 |
| 53 | 32 | 9·487251 | 16 104 | 10·512749 | 9·508759 | 16 115 | 10·491241 | 10·021507 | 16 11 | 9·978493 | 28 | 7 |
| 30 | 34 | 9·487447 | 17 111 | 10·512553 | 9·508975 | 17 123 | 10·491025 | 10·021528 | 17 12 | 9·978472 | 26 | 30 |
| 54 | 36 | 9·487643 | 18 117 | 10·512357 | 9·509191 | 18 130 | 10·490809 | 10·021548 | 18 12 | 9·978452 | 24 | 6 |
| 30 | 38 | 9·487838 | 19 124 | 10·512162 | 9·509407 | 19 137 | 10·490593 | 10·021569 | 19 13 | 9·978431 | 22 | 30 |
| 55 | 40 | 9·488034 | 20 131 | 10·511966 | 9·509622 | 20 144 | 10·490378 | 10·021589 | 20 14 | 9·978411 | 20 | 5 |
| 30 | 42 | 9·488229 | 21 137 | 10·511771 | 9·509838 | 21 151 | 10·490162 | 10·021609 | 21 14 | 9·978391 | 18 | 30 |
| 56 | 44 | 9·488424 | 22 144 | 10·511576 | 9·510054 | 22 159 | 10·489946 | 10·021630 | 22 15 | 9·978370 | 16 | 4 |
| 30 | 46 | 9·488619 | 23 150 | 10·511381 | 9·510269 | 23 166 | 10·489731 | 10·021650 | 23 16 | 9·978350 | 14 | 30 |
| 57 | 48 | 9·488814 | 24 157 | 10·511186 | 9·510485 | 24 173 | 10·489515 | 10·021671 | 24 16 | 9·978329 | 12 | 3 |
| 30 | 50 | 9·489009 | 25 163 | 10·510991 | 9·510700 | 25 180 | 10·489300 | 10·021691 | 25 17 | 9·978309 | 10 | 30 |
| 58 | 52 | 9·489204 | 26 170 | 10·510796 | 9·510916 | 26 187 | 10·489084 | 10·021712 | 26 18 | 9·978288 | 8 | 2 |
| 30 | 54 | 9·489399 | 27 176 | 10·510601 | 9·511131 | 27 195 | 10·488869 | 10·021732 | 27 18 | 9·978268 | 6 | 30 |
| 59 | 56 | 9·489593 | 28 183 | 10·510407 | 9·511346 | 28 202 | 10·488654 | 10·021753 | 28 19 | 9·978247 | 4 | 1 |
| 30 | 58 | 9·489788 | 29 189 | 10·510212 | 9·511561 | 29 209 | 10·488439 | 10·021773 | 29 20 | 9·978227 | 2 | 30 |
| 60 | **12** | 9·489982 | 30 196 | 10·510018 | 9·511776 | 30 216 | 10·488224 | 10·021794 | 30 20 | 9·978206 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

72° — 4h 48m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

1h 12m — 18°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·489982 | | 10·510018 | 9·511776 | | 10·488224 | 10·021794 | | 9·978206 | 28 | 60 |
| 30 | 2 | 9·490177 | 1″ 6 | 10·509823 | 9·511991 | 1″ 7 | 10·488009 | 10·021814 | 1″ 1 | 9·978186 | 58 | 30 |
| 1 | 4 | 9·490371 | 2 13 | 10·509629 | 9·512206 | 2 14 | 10·487794 | 10·021835 | 2 1 | 9·978165 | 56 | 59 |
| 30 | 6 | 9·490565 | 3 19 | 10·509435 | 9·512420 | 3 21 | 10·487580 | 10·021855 | 3 2 | 9·978145 | 54 | 30 |
| 2 | 8 | 9·490759 | 4 26 | 10·509241 | 9·512635 | 4 28 | 10·487365 | 10·021876 | 4 3 | 9·978124 | 52 | 58 |
| 30 | 10 | 9·490953 | 5 32 | 10·509047 | 9·512850 | 5 36 | 10·487150 | 10·021896 | 5 3 | 9·978104 | 50 | 30 |
| 3 | 12 | 9·491147 | 6 39 | 10·508853 | 9·513064 | 6 43 | 10·486936 | 10·021917 | 6 4 | 9·978083 | 48 | 57 |
| 30 | 14 | 9·491341 | 7 45 | 10·508659 | 9·513278 | 7 50 | 10·486722 | 10·021938 | 7 5 | 9·978062 | 46 | 30 |
| 4 | 16 | 9·491535 | 8 51 | 10·508465 | 9·513493 | 8 57 | 10·486507 | 10·021958 | 8 6 | 9·978042 | 44 | 56 |
| 30 | 18 | 9·491728 | 9 58 | 10·508272 | 9·513707 | 9 64 | 10·486293 | 10·021979 | 9 6 | 9·978021 | 42 | 30 |
| 5 | 20 | 9·491922 | 10 64 | 10·508078 | 9·513921 | 10 71 | 10·486079 | 10·021999 | 10 7 | 9·978001 | 40 | 55 |
| 30 | 22 | 9·492115 | 11 71 | 10·507885 | 9·514135 | 11 78 | 10·485865 | 10·022020 | 11 8 | 9·977980 | 38 | 30 |
| 6 | 24 | 9·492308 | 12 77 | 10·507692 | 9·514349 | 12 85 | 10·485651 | 10·022041 | 12 8 | 9·977959 | 36 | 54 |
| 30 | 26 | 9·492502 | 13 84 | 10·507498 | 9·514563 | 13 93 | 10·485437 | 10·022061 | 13 9 | 9·977939 | 34 | 30 |
| 7 | 28 | 9·492695 | 14 90 | 10·507305 | 9·514777 | 14 100 | 10·485223 | 10·022082 | 14 10 | 9·977918 | 32 | 53 |
| 30 | 30 | 9·492888 | 15 96 | 10·507112 | 9·514990 | 15 107 | 10·485010 | 10·022103 | 15 10 | 9·977897 | 30 | 30 |
| 8 | 32 | 9·493081 | 16 103 | 10·506919 | 9·515204 | 16 114 | 10·484796 | 10·022123 | 16 11 | 9·977877 | 28 | 52 |
| 30 | 34 | 9·493273 | 17 109 | 10·506727 | 9·515417 | 17 121 | 10·484583 | 10·022144 | 17 12 | 9·977856 | 26 | 30 |
| 9 | 36 | 9·493466 | 18 116 | 10·506534 | 9·515631 | 18 128 | 10·484369 | 10·022165 | 18 12 | 9·977835 | 24 | 51 |
| 30 | 38 | 9·493659 | 19 122 | 10·506341 | 9·515844 | 19 135 | 10·484156 | 10·022185 | 19 13 | 9·977815 | 22 | 30 |
| 10 | 40 | 9·493851 | 20 129 | 10·506149 | 9·516057 | 20 142 | 10·483943 | 10·022206 | 20 14 | 9·977794 | 20 | 50 |
| 30 | 42 | 9·494044 | 21 135 | 10·505956 | 9·516271 | 21 150 | 10·483729 | 10·022227 | 21 14 | 9·977773 | 18 | 30 |
| 11 | 44 | 9·494236 | 22 142 | 10·505764 | 9·516484 | 22 157 | 10·483516 | 10·022248 | 22 15 | 9·977752 | 16 | 49 |
| 30 | 46 | 9·494428 | 23 148 | 10·505572 | 9·516697 | 23 164 | 10·483303 | 10·022268 | 23 16 | 9·977732 | 14 | 30 |
| 12 | 48 | 9·494621 | 24 155 | 10·505379 | 9·516910 | 24 171 | 10·483090 | 10·022289 | 24 17 | 9·977711 | 12 | 48 |
| 30 | 50 | 9·494813 | 25 161 | 10·505187 | 9·517123 | 25 178 | 10·482877 | 10·022310 | 25 17 | 9·977690 | 10 | 30 |
| 13 | 52 | 9·495005 | 26 168 | 10·504995 | 9·517335 | 26 185 | 10·482665 | 10·022331 | 26 18 | 9·977669 | 8 | 47 |
| 30 | 54 | 9·495196 | 27 174 | 10·504804 | 9·517548 | 27 192 | 10·482452 | 10·022352 | 27 19 | 9·977648 | 6 | 30 |
| 14 | 56 | 9·495388 | 28 180 | 10·504612 | 9·517761 | 28 199 | 10·482239 | 10·022372 | 28 19 | 9·977628 | 4 | 46 |
| 30 | 58 | 9·495580 | 29 186 | 10·504420 | 9·517973 | 29 206 | 10·482027 | 10·022393 | 29 20 | 9·977607 | 2 | 30 |
| 15 | **13** | 9·495772 | 30 193 | 10·504228 | 9·518186 | 30 214 | 10·481814 | 10·022414 | 30 21 | 9·977586 | **47** | 45 |
| 30 | 2 | 9·495963 | 1 6 | 10·504037 | 9·518398 | 1 7 | 10·481602 | 10·022435 | 1 1 | 9·977565 | 58 | 30 |
| 16 | 4 | 9·496154 | 2 13 | 10·503846 | 9·518610 | 2 14 | 10·481390 | 10·022456 | 2 1 | 9·977544 | 56 | 44 |
| 30 | 6 | 9·496346 | 3 19 | 10·503654 | 9·518822 | 3 21 | 10·481178 | 10·022476 | 3 2 | 9·977524 | 54 | 30 |
| 17 | 8 | 9·496537 | 4 25 | 10·503463 | 9·519034 | 4 28 | 10·480966 | 10·022497 | 4 3 | 9·977503 | 52 | 43 |
| 30 | 10 | 9·496728 | 5 32 | 10·503272 | 9·519246 | 5 35 | 10·480754 | 10·022518 | 5 3 | 9·977482 | 50 | 30 |
| 18 | 12 | 9·496919 | 6 38 | 10·503081 | 9·519458 | 6 42 | 10·480542 | 10·022539 | 6 4 | 9·977461 | 48 | 42 |
| 30 | 14 | 9·497110 | 7 44 | 10·502890 | 9·519670 | 7 49 | 10·480330 | 10·022560 | 7 5 | 9·977440 | 46 | 30 |
| 19 | 16 | 9·497301 | 8 51 | 10·502699 | 9·519882 | 8 56 | 10·480118 | 10·022581 | 8 6 | 9·977419 | 44 | 41 |
| 30 | 18 | 9·497492 | 9 57 | 10·502508 | 9·520094 | 9 63 | 10·479906 | 10·022602 | 9 6 | 9·977398 | 42 | 30 |
| 20 | 20 | 9·497682 | 10 63 | 10·502318 | 9·520305 | 10 70 | 10·479695 | 10·022623 | 10 7 | 9·977377 | 40 | 40 |
| 30 | 22 | 9·497873 | 11 70 | 10·502127 | 9·520517 | 11 77 | 10·479483 | 10·022644 | 11 8 | 9·977356 | 38 | 30 |
| 21 | 24 | 9·498064 | 12 76 | 10·501936 | 9·520728 | 12 84 | 10·479272 | 10·022665 | 12 8 | 9·977335 | 36 | 39 |
| 30 | 26 | 9·498254 | 13 82 | 10·501746 | 9·520939 | 13 91 | 10·479061 | 10·022686 | 13 9 | 9·977314 | 34 | 30 |
| 22 | 28 | 9·498444 | 14 89 | 10·501556 | 9·521151 | 14 98 | 10·478849 | 10·022707 | 14 10 | 9·977293 | 32 | 38 |
| 30 | 30 | 9·498634 | 15 95 | 10·501366 | 9·521362 | 15 105 | 10·478638 | 10·022728 | 15 10 | 9·977272 | 30 | 30 |
| 23 | 32 | 9·498825 | 16 101 | 10·501175 | 9·521573 | 16 112 | 10·478427 | 10·022749 | 16 11 | 9·977251 | 28 | 37 |
| 30 | 34 | 9·499015 | 17 108 | 10·500985 | 9·521784 | 17 120 | 10·478216 | 10·022770 | 17 12 | 9·977230 | 26 | 30 |
| 24 | 36 | 9·499204 | 18 114 | 10·500796 | 9·521995 | 18 127 | 10·478005 | 10·022791 | 18 13 | 9·977209 | 24 | 36 |
| 30 | 38 | 9·499394 | 19 121 | 10·500606 | 9·522206 | 19 134 | 10·477794 | 10·022812 | 19 13 | 9·977188 | 22 | 30 |
| 25 | 40 | 9·499584 | 20 127 | 10·500416 | 9·522417 | 20 141 | 10·477583 | 10·022833 | 20 14 | 9·977167 | 20 | 35 |
| 30 | 42 | 9·499774 | 21 133 | 10·500226 | 9·522627 | 21 148 | 10·477373 | 10·022854 | 21 15 | 9·977146 | 18 | 30 |
| 26 | 44 | 9·499963 | 22 140 | 10·500037 | 9·522838 | 22 155 | 10·477162 | 10·022875 | 22 15 | 9·977125 | 16 | 34 |
| 30 | 46 | 9·500153 | 23 146 | 10·499847 | 9·523048 | 23 162 | 10·476952 | 10·022896 | 23 16 | 9·977104 | 14 | 30 |
| 27 | 48 | 9·500342 | 24 152 | 10·499658 | 9·523259 | 24 169 | 10·476741 | 10·022917 | 24 17 | 9·977083 | 12 | 33 |
| 30 | 50 | 9·500531 | 25 159 | 10·499469 | 9·523469 | 25 176 | 10·476531 | 10·022938 | 25 17 | 9·977062 | 10 | 30 |
| 28 | 52 | 9·500721 | 26 165 | 10·499279 | 9·523680 | 26 183 | 10·476320 | 10·022959 | 26 18 | 9·977041 | 8 | 32 |
| 30 | 54 | 9·500910 | 27 171 | 10·499090 | 9·523890 | 27 190 | 10·476110 | 10·022980 | 27 19 | 9·977020 | 6 | 30 |
| 29 | 56 | 9·501099 | 28 178 | 10·498901 | 9·524100 | 28 197 | 10·475900 | 10·023001 | 28 20 | 9·976999 | 4 | 31 |
| 30 | 58 | 9·501288 | 29 184 | 10·498712 | 9·524310 | 29 204 | 10·475690 | 10·023022 | 29 20 | 9·976978 | 2 | 30 |
| 30 | **14** | 9·501476 | 30 190 | 10·498524 | 9·524520 | 30 211 | 10·475480 | 10·023043 | 30 21 | 9·976957 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

71° — 4h 46m

TABLE XXVI.—(continued).

LOG. SINES, COSINES, &c.

$1^h\ 14^m$ — 18°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·501476 | | 10·498524 | 9·524520 | | 10·475480 | 10·023043 | | 9·976957 | **46** | 30 |
| 30 | 2 | 9·501665 | 1″ 6 | 10·498335 | 9·524730 | 1″ 7 | 10·475270 | 10·023065 | 1″ 1 | 9·976935 | 58 | 30 |
| 31 | 4 | 9·501854 | 2 12 | 10·498146 | 9·524940 | 2 14 | 10·475060 | 10·023086 | 2 1 | 9·976914 | 56 | 29 |
| 30 | 6 | 9·502042 | 3 19 | 10·497958 | 9·525149 | 3 21 | 10·474851 | 10·023107 | 3 2 | 9·976893 | 54 | 30 |
| 32 | 8 | 9·502231 | 4 25 | 10·497769 | 9·525359 | 4 28 | 10·474641 | 10·023128 | 4 3 | 9·976872 | 52 | 28 |
| 30 | 10 | 9·502419 | 5 31 | 10·497581 | 9·525568 | 5 35 | 10·474432 | 10·023149 | 5 4 | 9·976851 | 50 | 30 |
| 33 | 12 | 9·502607 | 6 37 | 10·497393 | 9·525778 | 6 42 | 10·474222 | 10·023170 | 6 4 | 9·976830 | 48 | 27 |
| 30 | 14 | 9·502796 | 7 44 | 10·497204 | 9·525987 | 7 49 | 10·474013 | 10·023192 | 7 5 | 9·976808 | 46 | 30 |
| 34 | 16 | 9·502984 | 8 50 | 10·497016 | 9·526197 | 8 56 | 10·473803 | 10·023213 | 8 6 | 9·976787 | 44 | 26 |
| 30 | 18 | 9·503172 | 9 56 | 10·496828 | 9·526406 | 9 63 | 10·473594 | 10·023234 | 9 6 | 9·976766 | 42 | 30 |
| 35 | 20 | 9·503360 | 10 62 | 10·496640 | 9·526615 | 10 70 | 10·473385 | 10·023255 | 10 7 | 9·976745 | 40 | 25 |
| 30 | 22 | 9·503548 | 11 69 | 10·496452 | 9·526824 | 11 77 | 10·473176 | 10·023277 | 11 8 | 9·976723 | 38 | 30 |
| 36 | 24 | 9·503735 | 12 75 | 10·496265 | 9·527033 | 12 84 | 10·472967 | 10·023298 | 12 9 | 9·976702 | 36 | 24 |
| 30 | 26 | 9·503923 | 13 81 | 10·496077 | 9·527242 | 13 90 | 10·472758 | 10·023319 | 13 9 | 9·976681 | 34 | 30 |
| 37 | 28 | 9·504110 | 14 87 | 10·495890 | 9·527451 | 14 97 | 10·472549 | 10·023340 | 14 10 | 9·976660 | 32 | 23 |
| 30 | 30 | 9·504298 | 15 94 | 10·495702 | 9·527660 | 15 104 | 10·472340 | 10·023362 | 15 11 | 9·976638 | 30 | 30 |
| 38 | 32 | 9·504485 | 16 100 | 10·495515 | 9·527868 | 16 111 | 10·472132 | 10·023383 | 16 11 | 9·976617 | 28 | 22 |
| 30 | 34 | 9·504673 | 17 106 | 10·495327 | 9·528077 | 17 118 | 10·471923 | 10·023404 | 17 12 | 9·976596 | 26 | 30 |
| 39 | 36 | 9·504860 | 18 112 | 10·495140 | 9·528285 | 18 125 | 10·471715 | 10·023426 | 18 13 | 9·976574 | 24 | 21 |
| 30 | 38 | 9·505047 | 19 119 | 10·494953 | 9·528494 | 19 132 | 10·471506 | 10·023447 | 19 13 | 9·976553 | 22 | 30 |
| 40 | 40 | 9·505234 | 20 125 | 10·494766 | 9·528702 | 20 139 | 10·471298 | 10·023468 | 20 14 | 9·976532 | 20 | 20 |
| 30 | 42 | 9·505421 | 21 131 | 10·494579 | 9·528910 | 21 146 | 10·471090 | 10·023490 | 21 15 | 9·976510 | 18 | 30 |
| 41 | 44 | 9·505608 | 22 137 | 10·494392 | 9·529119 | 22 153 | 10·470881 | 10·023511 | 22 16 | 9·976489 | 16 | 19 |
| 30 | 46 | 9·505794 | 23 144 | 10·494206 | 9·529327 | 23 160 | 10·470673 | 10·023532 | 23 16 | 9·976468 | 14 | 30 |
| 42 | 48 | 9·505981 | 24 150 | 10·494019 | 9·529535 | 24 167 | 10·470465 | 10·023554 | 24 17 | 9·976446 | 12 | 18 |
| 30 | 50 | 9·506168 | 25 156 | 10·493832 | 9·529743 | 25 174 | 10·470257 | 10·023575 | 25 18 | 9·976425 | 10 | 30 |
| 43 | 52 | 9·506354 | 26 162 | 10·493646 | 9·529951 | 26 181 | 10·470049 | 10·02359[illegible] | 26 18 | 9·976404 | 8 | 17 |
| 30 | 54 | 9·506541 | 27 169 | 10·493459 | 9·530158 | 27 188 | 10·469842 | 10·023618 | 27 19 | 9·976382 | 6 | 30 |
| 44 | 56 | 9·506727 | 28 175 | 10·493273 | 9·530366 | 28 195 | 10·469634 | 10·023639 | 28 20 | 9·976361 | 4 | 16 |
| 30 | 58 | 9·506913 | 29 181 | 10·493087 | 9·530574 | 29 202 | 10·469426 | 10·023661 | 29 21 | 9·976339 | 2 | 30 |
| 45 | **15** | 9·507099 | 30 187 | 10·492901 | 9·530781 | 30 209 | 10·469219 | 10·023682 | 30 21 | 9·976318 | **45** | 15 |
| 30 | 2 | 9·507285 | 1 6 | 10·492715 | 9·530989 | 1 7 | 10·469011 | 10·023704 | 1 1 | 9·976296 | 58 | 30 |
| 46 | 4 | 9·507471 | 2 12 | 10·492529 | 9·531196 | 2 14 | 10·468804 | 10·023725 | 2 1 | 9·976275 | 56 | 14 |
| 30 | 6 | 9·507657 | 3 18 | 10·492343 | 9·531403 | 3 21 | 10·468597 | 10·023746 | 3 2 | 9·976254 | 54 | 30 |
| 47 | 8 | 9·507843 | 4 25 | 10·492157 | 9·531611 | 4 28 | 10·468389 | 10·023768 | 4 3 | 9·976232 | 52 | 13 |
| 30 | 10 | 9·508028 | 5 31 | 10·491972 | 9·531818 | 5 34 | 10·468182 | 10·023789 | 5 4 | 9·976211 | 50 | 30 |
| 48 | 12 | 9·508214 | 6 37 | 10·491786 | 9·532025 | 6 41 | 10·467975 | 10·023811 | 6 4 | 9·976189 | 48 | 12 |
| 30 | 14 | 9·508400 | 7 43 | 10·491600 | 9·532232 | 7 48 | 10·467768 | 10·023832 | 7 5 | 9·976168 | 46 | 30 |
| 49 | 16 | 9·508585 | 8 49 | 10·491415 | 9·532439 | 8 55 | 10·467561 | 10·023854 | 8 6 | 9·976146 | 44 | 11 |
| 30 | 18 | 9·508770 | 9 55 | 10·491230 | 9·532646 | 9 62 | 10·467354 | 10·023875 | 9 6 | 9·976125 | 42 | 30 |
| 50 | 20 | 9·508956 | 10 62 | 10·491044 | 9·532853 | 10 69 | 10·467147 | 10·023897 | 10 7 | 9·976103 | 40 | 10 |
| 30 | 22 | 9·509141 | 11 68 | 10·490859 | 9·533059 | 11 76 | 10·466941 | 10·023919 | 11 8 | 9·976081 | 38 | 30 |
| 51 | 24 | 9·509326 | 12 74 | 10·490674 | 9·533266 | 12 83 | 10·466734 | 10·023940 | 12 9 | 9·976060 | 36 | 9 |
| 30 | 26 | 9·509511 | 13 80 | 10·490489 | 9·533472 | 13 89 | 10·466528 | 10·023962 | 13 9 | 9·976038 | 34 | 30 |
| 52 | 28 | 9·509696 | 14 86 | 10·490304 | 9·533679 | 14 96 | 10·466321 | 10·023983 | 14 10 | 9·976017 | 32 | 8 |
| 30 | 30 | 9·509880 | 15 92 | 10·490120 | 9·533885 | 15 103 | 10·466115 | 10·024005 | 15 11 | 9·975995 | 30 | 30 |
| 53 | 32 | 9·510065 | 16 99 | 10·489935 | 9·534092 | 16 110 | 10·465908 | 10·024026 | 16 12 | 9·975974 | 28 | 7 |
| 30 | 34 | 9·510250 | 17 105 | 10·489750 | 9·534298 | 17 117 | 10·465702 | 10·024048 | 17 12 | 9·975952 | 26 | 30 |
| 54 | 36 | 9·510434 | 18 111 | 10·489566 | 9·534504 | 18 124 | 10·465496 | 10·024070 | 18 13 | 9·975930 | 24 | 6 |
| 30 | 38 | 9·510619 | 19 117 | 10·489381 | 9·534710 | 19 131 | 10·465290 | 10·024091 | 19 14 | 9·975909 | 22 | 30 |
| 55 | 40 | 9·510803 | 20 123 | 10·489197 | 9·534916 | 20 138 | 10·465084 | 10·024113 | 20 14 | 9·975887 | 20 | 5 |
| 30 | 42 | 9·510987 | 21 129 | 10·489013 | 9·535122 | 21 144 | 10·464878 | 10·024135 | 21 15 | 9·975865 | 18 | 30 |
| 56 | 44 | 9·511172 | 22 135 | 10·488828 | 9·535328 | 22 151 | 10·464672 | 10·024156 | 22 16 | 9·975844 | 16 | 4 |
| 30 | 46 | 9·511356 | 23 142 | 10·488644 | 9·535534 | 23 158 | 10·464466 | 10·024178 | 23 17 | 9·975822 | 14 | 30 |
| 57 | 48 | 9·511540 | 24 148 | 10·488460 | 9·535739 | 24 165 | 10·464261 | 10·024200 | 24 17 | 9·975800 | 12 | 3 |
| 30 | 50 | 9·511724 | 25 154 | 10·488276 | 9·535945 | 25 172 | 10·464055 | 10·024221 | 25 18 | 9·975779 | 10 | 30 |
| 58 | 52 | 9·511907 | 26 160 | 10·488093 | 9·536150 | 26 178 | 10·463850 | 10·024243 | 26 19 | 9·975757 | 8 | 2 |
| 30 | 54 | 9·512091 | 27 166 | 10·487909 | 9·536356 | 27 186 | 10·463644 | 10·024265 | 27 19 | 9·975735 | 6 | 30 |
| 59 | 56 | 9·512275 | 28 172 | 10·487725 | 9·536561 | 28 193 | 10·463439 | 10·024286 | 28 20 | 9·975714 | 4 | 1 |
| 30 | 58 | 9·512458 | 29 179 | 10·487542 | 9·536767 | 29 200 | 10·463233 | 10·024308 | 29 21 | 9·975692 | 2 | 30 |
| 60 | **16** | 9·512642 | 30 185 | 10·487358 | 9·536972 | 30 206 | 10·463028 | 10·024330 | 30 22 | 9·975670 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

71° — $4^h\ 44^m$

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

1h 16m — 19°

| ′ ″ | m. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·512642 | | 10·487358 | 9·536972 | | 10·463028 | 10·024330 | | 9·975670 | **44** | 60 |
| 30 | 2 | 9·512825 | 1″ 6 | 10·487175 | 9·537177 | 1″ 7 | 10·462823 | 10·024352 | 1″ 1 | 9·975648 | 58 | 30 |
| 1 | 4 | 9·513009 | 2 12 | 10·486991 | 9·537382 | 2 14 | 10·462618 | 10·024373 | 2 1 | 9·975627 | 56 | 59 |
| 30 | 6 | 9·513192 | 3 18 | 10·486808 | 9·537587 | 3 20 | 10·462413 | 10·024395 | 3 2 | 9·975605 | 54 | 30 |
| 2 | 8 | 9·513375 | 4 24 | 10·486625 | 9·537792 | 4 27 | 10·462208 | 10·024417 | 4 3 | 9·975583 | 52 | 58 |
| 30 | 10 | 9·513558 | 5 30 | 10·486442 | 9·537997 | 5 34 | 10·462003 | 10·024439 | 5 4 | 9·975561 | 50 | 30 |
| 3 | 12 | 9·513741 | 6 36 | 10·486259 | 9·538202 | 6 41 | 10·461798 | 10·024461 | 6 4 | 9·975539 | 48 | 57 |
| 30 | 14 | 9·513924 | 7 43 | 10·486076 | 9·538406 | 7 48 | 10·461594 | 10·024482 | 7 5 | 9·975518 | 46 | 30 |
| 4 | 16 | 9·514107 | 8 49 | 10·485893 | 9·538611 | 8 54 | 10·461389 | 10·024504 | 8 6 | 9·975496 | 44 | 56 |
| 30 | 18 | 9·514289 | 9 55 | 10·485711 | 9·538816 | 9 61 | 10·461184 | 10·024526 | 9 7 | 9·975474 | 42 | 30 |
| 5 | 20 | 9·514472 | 10 61 | 10·485528 | 9·539020 | 10 68 | 10·460980 | 10·024548 | 10 7 | 9·975452 | 40 | 55 |
| 30 | 22 | 9·514655 | 11 67 | 10·485345 | 9·539224 | 11 75 | 10·460776 | 10·024570 | 11 8 | 9·975430 | 38 | 30 |
| 6 | 24 | 9·514837 | 12 73 | 10·485163 | 9·539429 | 12 82 | 10·460571 | 10·024592 | 12 9 | 9·975408 | 36 | 54 |
| 30 | 26 | 9·515019 | 13 79 | 10·484981 | 9·539633 | 13 88 | 10·460367 | 10·024614 | 13 9 | 9·975386 | 34 | 30 |
| 7 | 28 | 9·515202 | 14 85 | 10·484798 | 9·539837 | 14 95 | 10·460163 | 10·024635 | 14 10 | 9·975365 | 32 | 53 |
| 30 | 30 | 9·515384 | 15 91 | 10·484616 | 9·540041 | 15 102 | 10·459959 | 10·024657 | 15 11 | 9·975343 | 30 | 30 |
| 8 | 32 | 9·515566 | 16 97 | 10·484434 | 9·540245 | 16 109 | 10·459755 | 10·024679 | 16 12 | 9·975321 | 28 | 52 |
| 30 | 34 | 9·515748 | 17 103 | 10·484252 | 9·540449 | 17 116 | 10·459551 | 10·024701 | 17 12 | 9·975299 | 26 | 30 |
| 9 | 36 | 9·515930 | 18 109 | 10·484070 | 9·540653 | 18 122 | 10·459347 | 10·024723 | 18 13 | 9·975277 | 24 | 51 |
| 30 | 38 | 9·516112 | 19 115 | 10·483888 | 9·540857 | 19 129 | 10·459143 | 10·024745 | 19 14 | 9·975255 | 22 | 30 |
| 10 | 40 | 9·516294 | 20 121 | 10·483706 | 9·541061 | 20 136 | 10·458939 | 10·024767 | 20 15 | 9·975233 | 20 | 50 |
| 30 | 42 | 9·516475 | 21 127 | 10·483525 | 9·541264 | 21 143 | 10·458736 | 10·024789 | 21 15 | 9·975211 | 18 | 30 |
| 11 | 44 | 9·516657 | 22 134 | 10·483343 | 9·541468 | 22 150 | 10·458532 | 10·024811 | 22 16 | 9·975189 | 16 | 49 |
| 30 | 46 | 9·516838 | 23 140 | 10·483162 | 9·541671 | 23 156 | 10·458329 | 10·024833 | 23 17 | 9·975167 | 14 | 30 |
| 12 | 48 | 9·517020 | 24 146 | 10·482980 | 9·541875 | 24 163 | 10·458125 | 10·024855 | 24 18 | 9·975145 | 12 | 48 |
| 30 | 50 | 9·517201 | 25 152 | 10·482799 | 9·542078 | 25 170 | 10·457922 | 10·024877 | 25 18 | 9·975123 | 10 | 30 |
| 13 | 52 | 9·517382 | 26 158 | 10·482618 | 9·542281 | 26 177 | 10·457719 | 10·024899 | 26 19 | 9·975101 | 8 | 47 |
| 30 | 54 | 9·517564 | 27 164 | 10·482436 | 9·542485 | 27 184 | 10·457515 | 10·024921 | 27 20 | 9·975079 | 6 | 30 |
| 14 | 56 | 9·517745 | 28 170 | 10·482255 | 9·542688 | 28 190 | 10·457312 | 10·024943 | 28 20 | 9·975057 | 4 | 46 |
| 30 | 58 | 9·517926 | 29 176 | 10·482074 | 9·542891 | 29 197 | 10·457109 | 10·024965 | 29 21 | 9·975035 | 2 | 30 |
| 15 | **17** | 9·518107 | 30 182 | 10·481893 | 9·543094 | 30 204 | 10·456906 | 10·024987 | 30 22 | 9·975013 | **43** | 45 |
| 30 | 2 | 9·518287 | 1 6 | 10·481713 | 9·543297 | 1 7 | 10·456703 | 10·025009 | 1 1 | 9·974991 | 58 | 30 |
| 16 | 4 | 9·518468 | 2 12 | 10·481532 | 9·543499 | 2 13 | 10·456501 | 10·025031 | 2 1 | 9·974969 | 56 | 44 |
| 30 | 6 | 9·518649 | 3 18 | 10·481351 | 9·543702 | 3 20 | 10·456298 | 10·025053 | 3 2 | 9·974947 | 54 | 30 |
| 17 | 8 | 9·518829 | 4 24 | 10·481171 | 9·543905 | 4 27 | 10·456095 | 10·025075 | 4 3 | 9·974925 | 52 | 43 |
| 30 | 10 | 9·519010 | 5 30 | 10·480990 | 9·544107 | 5 34 | 10·455893 | 10·025098 | 5 4 | 9·974903 | 50 | 30 |
| 18 | 12 | 9·519190 | 6 36 | 10·480810 | 9·544310 | 6 40 | 10·455690 | 10·025120 | 6 4 | 9·974880 | 48 | 42 |
| 30 | 14 | 9·519371 | 7 42 | 10·480629 | 9·544512 | 7 47 | 10·455488 | 10·025142 | 7 5 | 9·974858 | 46 | 30 |
| 19 | 16 | 9·519551 | 8 48 | 10·480449 | 9·544715 | 8 54 | 10·455285 | 10·025164 | 8 6 | 9·974836 | 44 | 41 |
| 30 | 18 | 9·519731 | 9 54 | 10·480269 | 9·544917 | 9 61 | 10·455083 | 10·025186 | 9 7 | 9·974814 | 42 | 30 |
| 20 | 20 | 9·519911 | 10 60 | 10·480089 | 9·545119 | 10 67 | 10·454881 | 10·025208 | 10 7 | 9·974792 | 40 | 40 |
| 30 | 22 | 9·520091 | 11 66 | 10·479909 | 9·545322 | 11 74 | 10·454678 | 10·025230 | 11 8 | 9·974770 | 38 | 30 |
| 21 | 24 | 9·520271 | 12 72 | 10·479729 | 9·545524 | 12 81 | 10·454476 | 10·025253 | 12 9 | 9·974748 | 36 | 39 |
| 30 | 26 | 9·520451 | 13 78 | 10·479549 | 9·545726 | 13 87 | 10·454274 | 10·025275 | 13 10 | 9·974725 | 34 | 30 |
| 22 | 28 | 9·520631 | 14 84 | 10·479369 | 9·545928 | 14 94 | 10·454072 | 10·025297 | 14 10 | 9·974703 | 32 | 38 |
| 30 | 30 | 9·520810 | 15 90 | 10·479190 | 9·546129 | 15 101 | 10·453871 | 10·025319 | 15 11 | 9·974681 | 30 | 30 |
| 23 | 32 | 9·520990 | 16 96 | 10·479010 | 9·546331 | 16 108 | 10·453669 | 10·025341 | 16 12 | 9·974659 | 28 | 37 |
| 30 | 34 | 9·521169 | 17 102 | 10·478831 | 9·546533 | 17 114 | 10·453467 | 10·025364 | 17 13 | 9·974636 | 26 | 30 |
| 24 | 36 | 9·521349 | 18 108 | 10·478651 | 9·546735 | 18 121 | 10·453265 | 10·025386 | 18 13 | 9·974614 | 24 | 36 |
| 30 | 38 | 9·521528 | 19 114 | 10·478472 | 9·546936 | 19 128 | 10·453064 | 10·025408 | 19 14 | 9·974592 | 22 | 30 |
| 25 | 40 | 9·521707 | 20 120 | 10·478293 | 9·547138 | 20 135 | 10·452862 | 10·025430 | 20 15 | 9·974570 | 20 | 35 |
| 30 | 42 | 9·521887 | 21 126 | 10·478113 | 9·547339 | 21 141 | 10·452661 | 10·025453 | 21 16 | 9·974547 | 18 | 30 |
| 26 | 44 | 9·522066 | 22 132 | 10·477934 | 9·547540 | 22 148 | 10·452460 | 10·025475 | 22 16 | 9·974525 | 16 | 34 |
| 30 | 46 | 9·522245 | 23 138 | 10·477755 | 9·547742 | 23 155 | 10·452258 | 10·025497 | 23 17 | 9·974503 | 14 | 30 |
| 27 | 48 | 9·522424 | 24 144 | 10·477576 | 9·547943 | 24 162 | 10·452057 | 10·025519 | 24 18 | 9·974481 | 12 | 33 |
| 30 | 50 | 9·522602 | 25 150 | 10·477398 | 9·548144 | 25 168 | 10·451856 | 10·025542 | 25 18 | 9·974458 | 10 | 30 |
| 28 | 52 | 9·522781 | 26 156 | 10·477219 | 9·548345 | 26 175 | 10·451655 | 10·025564 | 26 19 | 9·974436 | 8 | 39 |
| 30 | 54 | 9·522960 | 27 162 | 10·477040 | 9·548546 | 27 182 | 10·451454 | 10·025586 | 27 20 | 9·974414 | 6 | 30 |
| 29 | 56 | 9·523138 | 28 168 | 10·476862 | 9·548747 | 28 188 | 10·451253 | 10·025609 | 28 21 | 9·974391 | 4 | 31 |
| 30 | 58 | 9·523317 | 29 174 | 10·476683 | 9·548948 | 29 195 | 10·451052 | 10·025631 | 29 21 | 9·974369 | 2 | 30 |
| 30 | **18** | 9·523495 | 30 180 | 10·476505 | 9·549149 | 30 202 | 10·450851 | 10·025653 | 30 22 | 9·974347 | 0 | 30 |
| ′ ″ | m. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |

70° — 4h 42m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

1ʰ 18ᵐ — 19°

| ′ ″ | m. s | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·523495 | | 10·476505 | 9·549149 | | 10·450851 | 10·025653 | · | 9·974347 | 42 | 30 |
| 30 | 2 | 9·523674 | 1″ 6 | 10·476326 | 9·549349 | 1″ 7 | 10·450651 | 10·025676 | 1″ 1 | 9·974324 | 58 | 30 |
| 31 | 4 | 9·523852 | 2 12 | 10·476148 | 9·549550 | 2 13 | 10·450450 | 10·025698 | 2 1 | 9·974302 | 56 | 29 |
| 30 | 6 | 9·524030 | 3 18 | 10·475970 | 9·549751 | 3 20 | 10·450249 | 10·025721 | 3 2 | 9·974279 | 54 | 30 |
| 32 | 8 | 9·524208 | 4 24 | 10·475792 | 9·549951 | 4 27 | 10·450049 | 10·025743 | 4 3 | 9·974257 | 52 | 28 |
| 30 | 10 | 9·524386 | 5 30 | 10·475614 | 9·550152 | 5 33 | 10·449848 | 10·025765 | 5 4 | 9·974235 | 50 | 30 |
| 33 | 12 | 9·524564 | 6 35 | 10·475436 | 9·550352 | 6 40 | 10·449648 | 10·025788 | 6 4 | 9·974212 | 48 | 27 |
| 30 | 14 | 9·524742 | 7 41 | 10·475258 | 9·550552 | 7 47 | 10·449448 | 10·025810 | 7 5 | 9·974190 | 46 | 30 |
| 34 | 16 | 9·524920 | 8 47 | 10·475080 | 9·550752 | 8 53 | 10·449248 | 10·025833 | 8 6 | 9·974167 | 44 | 26 |
| 30 | 18 | 9·525097 | 9 53 | 10·474903 | 9·550952 | 9 60 | 10·449048 | 10·025855 | 9 7 | 9·974145 | 42 | 30 |
| 35 | 20 | 9·525275 | 10 59 | 10·474725 | 9·551153 | 10 66 | 10·448847 | 10·025878 | 10 7 | 9·974122 | 40 | 25 |
| 30 | 22 | 9·525452 | 11 65 | 10·474548 | 9·551353 | 11 73 | 10·448647 | 10·025900 | 11 8 | 9·974100 | 38 | 30 |
| 36 | 24 | 9·525630 | 12 71 | 10·474370 | 9·551552 | 12 80 | 10·448448 | 10·025923 | 12 9 | 9·974077 | 36 | 24 |
| 30 | 26 | 9·525807 | 13 77 | 10·474193 | 9·551752 | 13 86 | 10·448248 | 10·025945 | 13 10 | 9·974055 | 34 | 30 |
| 37 | 28 | 9·525984 | 14 83 | 10·474016 | 9·551952 | 14 93 | 10·448048 | 10·025968 | 14 10 | 9·974032 | 32 | 23 |
| 30 | 30 | 9·526162 | 15 89 | 10·473838 | 9·552152 | 15 98 | 10·447848 | 10·025990 | 15 11 | 9·974010 | 30 | 30 |
| 38 | 32 | 9·526339 | 16 94 | 10·473661 | 9·552351 | 16 106 | 10·447649 | 10·026013 | 16 12 | 9·973987 | 28 | 22 |
| 30 | 34 | 9·526516 | 17 100 | 10·473484 | 9·552551 | 17 113 | 10·447449 | 10·026035 | 17 13 | 9·973965 | 26 | 30 |
| 39 | 36 | 9·526693 | 18 106 | 10·473307 | 9·552750 | 18 120 | 10·447250 | 10·026058 | 18 13 | 9·973942 | 24 | 21 |
| 30 | 38 | 9·526870 | 19 112 | 10·473130 | 9·552950 | 19 126 | 10·447050 | 10·026080 | 19 14 | 9·973920 | 22 | 30 |
| 40 | 40 | 9·527046 | 20 118 | 10·472954 | 9·553149 | 20 133 | 10·446851 | 10·026103 | 20 15 | 9·973897 | 20 | 20 |
| 30 | 42 | 9·527223 | 21 124 | 10·472777 | 9·553348 | 21 140 | 10·446652 | 10·026126 | 21 16 | 9·973875 | 18 | 30 |
| 41 | 44 | 9·527400 | 22 130 | 10·472600 | 9·553548 | 22 146 | 10·446452 | 10·026148 | 22 16 | 9·973852 | 16 | 19 |
| 30 | 46 | 9·527576 | 23 136 | 10·472424 | 9·553747 | 23 153 | 10·446253 | 10·026171 | 23 17 | 9·973829 | 14 | 30 |
| 42 | 48 | 9·527753 | 24 142 | 10·472247 | 9·553946 | 24 160 | 10·446054 | 10·026193 | 24 18 | 9·973807 | 12 | 18 |
| 30 | 50 | 9·527929 | 25 148 | 10·472071 | 9·554145 | 25 166 | 10·445855 | 10·026216 | 25 19 | 9·973784 | 10 | 30 |
| 43 | 52 | 9·528105 | 26 153 | 10·471895 | 9·554344 | 26 173 | 10·445656 | 10·026239 | 26 19 | 9·973761 | 8 | 17 |
| 30 | 54 | 9·528282 | 27 159 | 10·471718 | 9·554543 | 27 180 | 10·445457 | 10·026261 | 27 20 | 9·973739 | 6 | 30 |
| 44 | 56 | 9·528458 | 28 165 | 10·471542 | 9·554741 | 28 186 | 10·445259 | 10·026284 | 28 21 | 9·973716 | 4 | 16 |
| 30 | 58 | 9·528634 | 29 171 | 10·471366 | 9·554940 | 29 193 | 10·445060 | 10·026307 | 29 22 | 9·973694 | 2 | 30 |
| 46 | **19** | 9·528810 | 30 177 | 10·471190 | 9·555139 | 30 199 | 10·444861 | 10·026329 | 30 22 | 9·973671 | **41** | 15 |
| 30 | 2 | 9·528986 | 1 6 | 10·471014 | 9·555337 | 1 7 | 10·444663 | 10·026352 | 1 1 | 9·973648 | 58 | 30 |
| 46 | 4 | 9·529161 | 2 12 | 10·470839 | 9·555536 | 2 13 | 10·444464 | 10·026375 | 2 2 | 9·973625 | 56 | 14 |
| 30 | 6 | 9·529337 | 3 17 | 10·470663 | 9·555734 | 3 20 | 10·444266 | 10·026397 | 3 2 | 9·973603 | 54 | 30 |
| 47 | 8 | 9·529513 | 4 23 | 10·470487 | 9·555933 | 4 26 | 10·444067 | 10·026420 | 4 3 | 9·973580 | 52 | 13 |
| 30 | 10 | 9·529688 | 5 29 | 10·470312 | 9·556131 | 5 33 | 10·443869 | 10·026443 | 5 4 | 9·973557 | 50 | 30 |
| 48 | 12 | 9·529864 | 6 35 | 10·470136 | 9·556329 | 6 40 | 10·443671 | 10·026465 | 6 5 | 9·973535 | 48 | 12 |
| 30 | 14 | 9·530039 | 7 41 | 10·469961 | 9·556527 | 7 46 | 10·443473 | 10·026488 | 7 5 | 9·973512 | 46 | 30 |
| 49 | 16 | 9·530215 | 8 47 | 10·469785 | 9·556725 | 8 53 | 10·443275 | 10·026511 | 8 6 | 9·973489 | 44 | 11 |
| 30 | 18 | 9·530390 | 9 52 | 10·469610 | 9·556923 | 9 59 | 10·443077 | 10·026534 | 9 7 | 9·973466 | 42 | 30 |
| 50 | 20 | 9·530565 | 10 58 | 10·469435 | 9·557121 | 10 66 | 10·442879 | 10·026556 | 10 8 | 9·973444 | 40 | 10 |
| 30 | 22 | 9·530740 | 11 64 | 10·469260 | 9·557319 | 11 72 | 10·442681 | 10·026579 | 11 8 | 9·973421 | 38 | 30 |
| 51 | 24 | 9·530915 | 12 70 | 10·469085 | 9·557517 | 12 79 | 10·442483 | 10·026602 | 12 9 | 9·973398 | 36 | 9 |
| 30 | 26 | 9·531090 | 13 76 | 10·468910 | 9·557715 | 13 86 | 10·442285 | 10·026625 | 13 10 | 9·973375 | 34 | 30 |
| 52 | 28 | 9·531265 | 14 81 | 10·468735 | 9·557913 | 14 92 | 10·442087 | 10·026648 | 14 10 | 9·973352 | 32 | 8 |
| 30 | 30 | 9·531440 | 15 87 | 10·468560 | 9·558110 | 15 99 | 10·441890 | 10·026671 | 15 11 | 9·973330 | 30 | 30 |
| 53 | 32 | 9·531614 | 16 93 | 10·468386 | 9·558308 | 16 105 | 10·441692 | 10·026693 | 16 12 | 9·973307 | 28 | 7 |
| 30 | 34 | 9·531789 | 17 99 | 10·468211 | 9·558505 | 17 112 | 10·441495 | 10·026716 | 17 13 | 9·973284 | 26 | 30 |
| 54 | 36 | 9·531963 | 18 105 | 10·468037 | 9·558703 | 18 119 | 10·441297 | 10·026739 | 18 14 | 9·973261 | 24 | 6 |
| 30 | 38 | 9·532138 | 19 111 | 10·467862 | 9·558900 | 19 125 | 10·441100 | 10·026762 | 19 14 | 9·973238 | 22 | 30 |
| 55 | 40 | 9·532312 | 20 117 | 10·467688 | 9·559097 | 20 132 | 10·440903 | 10·026785 | 20 15 | 9·973215 | 20 | 5 |
| 30 | 42 | 9·532487 | 21 123 | 10·467513 | 9·559294 | 21 138 | 10·440706 | 10·026808 | 21 16 | 9·973192 | 18 | 30 |
| 56 | 44 | 9·532661 | 22 128 | 10·467339 | 9·559491 | 22 145 | 10·440509 | 10·026831 | 22 17 | 9·973169 | 16 | 4 |
| 30 | 46 | 9·532835 | 23 134 | 10·467165 | 9·559688 | 23 152 | 10·440312 | 10·026854 | 23 17 | 9·973146 | 14 | 30 |
| 57 | 48 | 9·533009 | 24 140 | 10·466991 | 9·559885 | 24 158 | 10·440115 | 10·026876 | 24 18 | 9·973124 | 12 | 3 |
| 30 | 50 | 9·533183 | 25 146 | 10·466817 | 9·560082 | 25 165 | 10·439918 | 10·026899 | 25 19 | 9·973101 | 10 | 30 |
| 58 | 52 | 9·533357 | 26 152 | 10·466643 | 9·560279 | 26 171 | 10·439721 | 10·026922 | 26 20 | 9·973078 | 8 | 2 |
| 30 | 54 | 9·533531 | 27 158 | 10·466469 | 9·560476 | 27 178 | 10·439524 | 10·026945 | 27 21 | 9·973055 | 6 | 30 |
| 59 | 56 | 9·533704 | 28 164 | 10·466296 | 9·560673 | 28 185 | 10·439327 | 10·026968 | 28 21 | 9·973032 | 4 | 1 |
| 30 | 58 | 9·533878 | 29 169 | 10·466122 | 9·560869 | 29 191 | 10·439131 | 10·026991 | 29 22 | 9·973009 | 2 | 30 |
| 60 | **20** | 9·534052 | 30 175 | 10·465948 | 9·561066 | 30 198 | 10·438934 | 10·027014 | 30 23 | 9·972986 | 0 | 0 |
| ′ ″ | m. s | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s | ′ ″ |

70° — 4ʰ 40ᵐ

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

1ʰ 20ᵐ — 20°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·534052 | | 10·465948 | 9·561066 | | 10·438934 | 10·027014 | | 9·972986 | 40 | 60 |
| 30 | 2 | 9·534225 | 1″ 6 | 10·465775 | 9·561262 | 1″ 7 | 10·438738 | 10·027037 | 1″ 1 | 9·972963 | 58 | 30 |
| 1 | 4 | 9·534399 | 2 11 | 10·465601 | 9·561459 | 2 13 | 10·438541 | 10·027060 | 2 2 | 9·972940 | 56 | 59 |
| 30 | 6 | 9·534572 | 3 17 | 10·465428 | 9·561655 | 3 20 | 10·438345 | 10·027083 | 3 2 | 9·972917 | 54 | 30 |
| 2 | 8 | 9·534745 | 4 23 | 10·465255 | 9·561851 | 4 26 | 10·438149 | 10·027106 | 4 3 | 9·972894 | 52 | 58 |
| 30 | 10 | 9·534918 | 5 29 | 10·465082 | 9·562048 | 5 33 | 10·437952 | 10·027129 | 5 4 | 9·972871 | 50 | 30 |
| 3 | 12 | 9·535092 | 6 34 | 10·464908 | 9·562244 | 6 39 | 10·437756 | 10·027152 | 6 5 | 9·972848 | 48 | 57 |
| 30 | 14 | 9·535265 | 7 40 | 10·464735 | 9·562440 | 7 46 | 10·437560 | 10·027175 | 7 5 | 9·972825 | 46 | 30 |
| 4 | 16 | 9·535438 | 8 46 | 10·464562 | 9·562636 | 8 52 | 10·437364 | 10·027198 | 8 6 | 9·972802 | 44 | 56 |
| 30 | 18 | 9·535610 | 9 52 | 10·464390 | 9·562832 | 9 59 | 10·437168 | 10·027222 | 9 7 | 9·972778 | 42 | 30 |
| 5 | 20 | 9·535783 | 10 57 | 10·464217 | 9·563028 | 10 65 | 10·436972 | 10·027245 | 10 8 | 9·972755 | 40 | 55 |
| 30 | 22 | 9·535956 | 11 63 | 10·464044 | 9·563224 | 11 72 | 10·436776 | 10·027268 | 11 8 | 9·972732 | 38 | 30 |
| 6 | 24 | 9·536129 | 12 69 | 10·463871 | 9·563419 | 12 78 | 10·436581 | 10·027291 | 12 9 | 9·972709 | 36 | 54 |
| 30 | 26 | 9·536301 | 13 75 | 10·463699 | 9·563615 | 13 85 | 10·436385 | 10·027314 | 13 10 | 9·972686 | 34 | 30 |
| 7 | 28 | 9·536474 | 14 80 | 10·463526 | 9·563811 | 14 91 | 10·436189 | 10·027337 | 14 11 | 9·972663 | 32 | 53 |
| 30 | 30 | 9·536646 | 15 86 | 10·463354 | 9·564006 | 15 98 | 10·435994 | 10·027360 | 15 12 | 9·972640 | 30 | 30 |
| 8 | 32 | 9·536818 | 16 92 | 10·463182 | 9·564202 | 16 104 | 10·435798 | 10·027383 | 16 12 | 9·972617 | 28 | 52 |
| 30 | 34 | 9·536991 | 17 98 | 10·463009 | 9·564397 | 17 111 | 10·435603 | 10·027407 | 17 13 | 9·972593 | 26 | 30 |
| 9 | 36 | 9·537163 | 18 103 | 10·462837 | 9·564593 | 18 117 | 10·435407 | 10·027430 | 18 14 | 9·972570 | 24 | 51 |
| 30 | 38 | 9·537335 | 19 109 | 10·462665 | 9·564788 | 19 124 | 10·435212 | 10·027453 | 19 15 | 9·972547 | 22 | 30 |
| 10 | 40 | 9·537507 | 20 115 | 10·462493 | 9·564983 | 20 130 | 10·435017 | 10·027476 | 20 15 | 9·972524 | 20 | 50 |
| 30 | 42 | 9·537679 | 21 121 | 10·462321 | 9·565178 | 21 137 | 10·434822 | 10·027499 | 21 16 | 9·972501 | 18 | 30 |
| 11 | 44 | 9·537851 | 22 126 | 10·462149 | 9·565373 | 22 143 | 10·434627 | 10·027522 | 22 17 | 9·972478 | 16 | 49 |
| 30 | 46 | 9·538023 | 23 132 | 10·461977 | 9·565568 | 23 150 | 10·434432 | 10·027546 | 23 18 | 9·972454 | 14 | 30 |
| 12 | 48 | 9·538194 | 24 138 | 10·461806 | 9·565763 | 24 156 | 10·434237 | 10·027569 | 24 18 | 9·972431 | 12 | 48 |
| 30 | 50 | 9·538366 | 25 144 | 10·461634 | 9·565958 | 25 163 | 10·434042 | 10·027592 | 25 19 | 9·972408 | 10 | 30 |
| 13 | 52 | 9·538538 | 26 149 | 10·461462 | 9·566153 | 26 170 | 10·433847 | 10·027615 | 26 20 | 9·972385 | 8 | 47 |
| 30 | 54 | 9·538709 | 27 155 | 10·461291 | 9·566348 | 27 176 | 10·433652 | 10·027639 | 27 21 | 9·972361 | 6 | 30 |
| 14 | 56 | 9·538880 | 28 161 | 10·461120 | 9·566542 | 28 183 | 10·433458 | 10·027662 | 28 22 | 9·972338 | 4 | 46 |
| 30 | 58 | 9·539052 | 29 167 | 10·460948 | 9·566737 | 29 189 | 10·433263 | 10·027685 | 29 22 | 9·972315 | 2 | 30 |
| 15 | **21** | 9·539223 | 30 172 | 10·460777 | 9·566932 | 30 196 | 10·433068 | 10·027709 | 30 23 | 9·972291 | **39** | 45 |
| 30 | 2 | 9·539394 | 1 6 | 10·460606 | 9·567126 | 1 6 | 10·432874 | 10·027732 | 1 1 | 9·972268 | 58 | 30 |
| 16 | 4 | 9·539565 | 2 11 | 10·460435 | 9·567320 | 2 13 | 10·432680 | 10·027755 | 2 2 | 9·972245 | 56 | 44 |
| 30 | 6 | 9·539736 | 3 17 | 10·460264 | 9·567515 | 3 19 | 10·432485 | 10·027779 | 3 2 | 9·972221 | 54 | 30 |
| 17 | 8 | 9·539907 | 4 23 | 10·460093 | 9·567709 | 4 26 | 10·432291 | 10·027802 | 4 3 | 9·972198 | 52 | 43 |
| 30 | 10 | 9·540078 | 5 28 | 10·459922 | 9·567903 | 5 32 | 10·432097 | 10·027825 | 5 4 | 9·972175 | 50 | 30 |
| 18 | 12 | 9·540249 | 6 34 | 10·459751 | 9·568098 | 6 39 | 10·431902 | 10·027849 | 6 5 | 9·972151 | 48 | 42 |
| 30 | 14 | 9·540420 | 7 40 | 10·459580 | 9·568292 | 7 45 | 10·431708 | 10·027872 | 7 5 | 9·972128 | 46 | 30 |
| 19 | 16 | 9·540590 | 8 45 | 10·459410 | 9·568486 | 8 52 | 10·431514 | 10·027895 | 8 6 | 9·972105 | 44 | 41 |
| 30 | 18 | 9·540761 | 9 51 | 10·459239 | 9·568680 | 9 58 | 10·431320 | 10·027919 | 9 7 | 9·972081 | 42 | 30 |
| 20 | 20 | 9·540931 | 10 57 | 10·459069 | 9·568873 | 10 64 | 10·431127 | 10·027942 | 10 8 | 9·972058 | 40 | 40 |
| 30 | 22 | 9·541102 | 11 62 | 10·458898 | 9·569067 | 11 71 | 10·430933 | 10·027966 | 11 9 | 9·972034 | 38 | 30 |
| 21 | 24 | 9·541272 | 12 68 | 10·458728 | 9·569261 | 12 77 | 10·430739 | 10·027989 | 12 9 | 9·972011 | 36 | 39 |
| 30 | 26 | 9·541442 | 13 74 | 10·458558 | 9·569455 | 13 84 | 10·430545 | 10·028012 | 13 10 | 9·971988 | 34 | 30 |
| 22 | 28 | 9·541613 | 14 79 | 10·458387 | 9·569648 | 14 90 | 10·430352 | 10·028036 | 14 11 | 9·971964 | 32 | 38 |
| 30 | 30 | 9·541783 | 15 85 | 10·458217 | 9·569842 | 15 97 | 10·430158 | 10·028059 | 15 12 | 9·971941 | 30 | 30 |
| 23 | 32 | 9·541953 | 16 91 | 10·458047 | 9·570035 | 16 103 | 10·429965 | 10·028083 | 16 12 | 9·971917 | 28 | 37 |
| 30 | 34 | 9·542123 | 17 96 | 10·457877 | 9·570229 | 17 110 | 10·429771 | 10·028106 | 17 13 | 9·971894 | 26 | 30 |
| 24 | 36 | 9·542293 | 18 102 | 10·457707 | 9·570422 | 18 116 | 10·429578 | 10·028130 | 18 14 | 9·971870 | 24 | 36 |
| 30 | 38 | 9·542462 | 19 108 | 10·457538 | 9·570616 | 19 123 | 10·429384 | 10·028153 | 19 15 | 9·971847 | 22 | 30 |
| 25 | 40 | 9·542632 | 20 113 | 10·457368 | 9·570809 | 20 129 | 10·429191 | 10·028177 | 20 16 | 9·971823 | 20 | 35 |
| 30 | 42 | 9·542802 | 21 119 | 10·457198 | 9·571002 | 21 135 | 10·428998 | 10·028200 | 21 16 | 9·971800 | 18 | 30 |
| 26 | 44 | 9·542971 | 22 125 | 10·457029 | 9·571195 | 22 142 | 10·428805 | 10·028224 | 22 17 | 9·971776 | 16 | 34 |
| 30 | 46 | 9·543141 | 23 130 | 10·456859 | 9·571388 | 23 148 | 10·428612 | 10·028247 | 23 18 | 9·971753 | 14 | 30 |
| 27 | 48 | 9·543310 | 24 136 | 10·456690 | 9·571581 | 24 155 | 10·428419 | 10·028271 | 24 19 | 9·971729 | 12 | 33 |
| 30 | 50 | 9·543480 | 25 142 | 10·456520 | 9·571774 | 25 161 | 10·428226 | 10·028294 | 25 19 | 9·971706 | 10 | 30 |
| 28 | 52 | 9·543649 | 26 147 | 10·456351 | 9·571967 | 26 168 | 10·428033 | 10·028318 | 26 20 | 9·971682 | 8 | 32 |
| 30 | 54 | 9·543818 | 27 153 | 10·456182 | 9·572160 | 27 174 | 10·427840 | 10·028342 | 27 21 | 9·971658 | 6 | 30 |
| 29 | 56 | 9·543987 | 28 159 | 10·456013 | 9·572352 | 28 181 | 10·427648 | 10·028365 | 28 22 | 9·971635 | 4 | 31 |
| 30 | 58 | 9·544156 | 29 164 | 10·455844 | 9·572545 | 29 187 | 10·427455 | 10·028389 | 29 23 | 9·971611 | 2 | 30 |
| 30 | **22** | 9·544325 | 30 170 | 10·455675 | 9·572738 | 30 193 | 10·427262 | 10·028412 | 30 23 | 9·971588 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

69° — 4ʰ 38ᵐ

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

1h 22m — 20°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·544325 | | 10·455675 | 9·572738 | | 10·427262 | 10·028412 | | 9·971588 | 38 | 30 |
| 30 | 2 | 9·544494 | 1″ 6 | 10·455506 | 9·572930 | 1″ 6 | 10·427070 | 10·028436 | 1″ 1 | 9·971564 | 58 | 30 |
| 31 | 4 | 9·544663 | 2 11 | 10·455337 | 9·573123 | 2 13 | 10·426877 | 10·028460 | 2 2 | 9·971540 | 56 | 29 |
| 30 | 6 | 9·544832 | 3 17 | 10·455168 | 9·573315 | 3 19 | 10·426685 | 10·028483 | 3 2 | 9·971517 | 54 | 30 |
| 32 | 8 | 9·545000 | 4 22 | 10·455000 | 9·573507 | 4 26 | 10·426493 | 10·028507 | 4 3 | 9·971493 | 52 | 28 |
| 30 | 10 | 9·545169 | 5 28 | 10·454831 | 9·573700 | 5 32 | 10·426300 | 10·028531 | 5 4 | 9·971469 | 50 | 30 |
| 33 | 12 | 9·545338 | 6 34 | 10·454662 | 9·573892 | 6 38 | 10·426108 | 10·028554 | 6 5 | 9·971446 | 48 | 27 |
| 30 | 14 | 9·545506 | 7 39 | 10·454494 | 9·574084 | 7 45 | 10·425916 | 10·028578 | 7 6 | 9·971422 | 46 | 30 |
| 34 | 16 | 9·545674 | 8 45 | 10·454326 | 9·574276 | 8 51 | 10·425724 | 10·028602 | 8 6 | 9·971398 | 44 | 26 |
| 30 | 18 | 9·545843 | 9 50 | 10·454157 | 9·574468 | 9 58 | 10·425532 | 10·028625 | 9 7 | 9·971375 | 42 | 30 |
| 35 | 20 | 9·546011 | 10 56 | 10·453989 | 9·574660 | 10 64 | 10·425340 | 10·028649 | 10 8 | 9·971351 | 40 | 25 |
| 30 | 22 | 9·546179 | 11 61 | 10·453821 | 9·574852 | 11 70 | 10·425148 | 10·028673 | 11 9 | 9·971327 | 38 | 30 |
| 36 | 24 | 9·546347 | 12 67 | 10·453653 | 9·575044 | 12 77 | 10·424956 | 10·028697 | 12 9 | 9·971303 | 36 | 24 |
| 30 | 26 | 9·546515 | 13 72 | 10·453485 | 9·575236 | 13 83 | 10·424764 | 10·028720 | 13 10 | 9·971280 | 34 | 30 |
| 37 | 28 | 9·546683 | 14 78 | 10·453317 | 9·575427 | 14 89 | 10·424573 | 10·028744 | 14 11 | 9·971256 | 32 | 23 |
| 30 | 30 | 9·546851 | 15 84 | 10·453149 | 9·575619 | 15 96 | 10·424381 | 10·028768 | 15 12 | 9·971232 | 30 | 30 |
| 38 | 32 | 9·547019 | 16 90 | 10·452981 | 9·575810 | 16 102 | 10·424190 | 10·028792 | 16 13 | 9·971208 | 28 | 22 |
| 30 | 34 | 9·547187 | 17 95 | 10·452813 | 9·576002 | 17 109 | 10·423998 | 10·028815 | 17 13 | 9·971185 | 26 | 30 |
| 39 | 36 | 9·547354 | 18 101 | 10·452646 | 9·576193 | 18 115 | 10·423807 | 10·028839 | 18 14 | 9·971161 | 24 | 21 |
| 30 | 38 | 9·547522 | 19 107 | 10·452478 | 9·576385 | 19 121 | 10·423615 | 10·028863 | 19 15 | 9·971137 | 22 | 30 |
| 40 | 40 | 9·547689 | 20 112 | 10·452311 | 9·576576 | 20 128 | 10·423424 | 10·028887 | 20 16 | 9·971113 | 20 | 20 |
| 30 | 42 | 9·547857 | 21 118 | 10·452143 | 9·576767 | 21 134 | 10·423233 | 10·028911 | 21 17 | 9·971089 | 18 | 30 |
| 41 | 44 | 9·548024 | 22 123 | 10·451976 | 9·576959 | 22 141 | 10·423041 | 10·028934 | 22 17 | 9·971066 | 16 | 19 |
| 30 | 46 | 9·548191 | 23 129 | 10·451809 | 9·577150 | 23 147 | 10·422850 | 10·028958 | 23 18 | 9·971042 | 14 | 30 |
| 42 | 48 | 9·548359 | 24 134 | 10·451641 | 9·577341 | 24 153 | 10·422659 | 10·028982 | 24 19 | 9·971018 | 12 | 18 |
| 30 | 50 | 9·548526 | 25 140 | 10·451474 | 9·577532 | 25 160 | 10·422468 | 10·029006 | 25 20 | 9·970994 | 10 | 30 |
| 43 | 52 | 9·548693 | 26 145 | 10·451307 | 9·577723 | 26 166 | 10·422277 | 10·029030 | 26 21 | 9·970970 | 8 | 17 |
| 30 | 54 | 9·548860 | 27 151 | 10·451140 | 9·577914 | 27 173 | 10·422086 | 10·029054 | 27 21 | 9·970946 | 6 | 30 |
| 44 | 56 | 9·549027 | 28 156 | 10·450973 | 9·578104 | 28 179 | 10·421896 | 10·029078 | 28 22 | 9·970922 | 4 | 16 |
| 30 | 58 | 9·549193 | 29 162 | 10·450807 | 9·578295 | 29 185 | 10·421705 | 10·029102 | 29 23 | 9·970898 | 2 | 30 |
| 45 | **23** | 9·549360 | 30 168 | 10·450640 | 9·578486 | 30 192 | 10·421514 | 10·029126 | 30 24 | 9·970874 | **37** | 15 |
| 30 | 2 | 9·549527 | 1 6 | 10·450473 | 9·578676 | 1 6 | 10·421324 | 10·029150 | 1 1 | 9·970850 | 58 | 30 |
| 46 | 4 | 9·549693 | 2 11 | 10·450307 | 9·578867 | 2 13 | 10·421133 | 10·029173 | 2 2 | 9·970827 | 56 | 14 |
| 30 | 6 | 9·549860 | 3 17 | 10·450140 | 9·579057 | 3 19 | 10·420943 | 10·029197 | 3 2 | 9·970803 | 54 | 30 |
| 47 | 8 | 9·550026 | 4 22 | 10·449974 | 9·579248 | 4 25 | 10·420752 | 10·029221 | 4 3 | 9·970779 | 52 | 13 |
| 30 | 10 | 9·550193 | 5 28 | 10·449807 | 9·579438 | 5 32 | 10·420562 | 10·029245 | 5 4 | 9·970755 | 50 | 30 |
| 48 | 12 | 9·550359 | 6 33 | 10·449641 | 9·579629 | 6 38 | 10·420371 | 10·029269 | 6 5 | 9·970731 | 48 | 12 |
| 30 | 14 | 9·550525 | 7 39 | 10·449475 | 9·579819 | 7 44 | 10·420181 | 10·029293 | 7 6 | 9·970707 | 46 | 30 |
| 49 | 16 | 9·550692 | 8 44 | 10·449308 | 9·580009 | 8 51 | 10·419991 | 10·029317 | 8 6 | 9·970683 | 44 | 11 |
| 30 | 18 | 9·550858 | 9 50 | 10·449142 | 9·580199 | 9 57 | 10·419801 | 10·029341 | 9 7 | 9·970659 | 42 | 30 |
| 50 | 20 | 9·551024 | 10 55 | 10·448976 | 9·580389 | 10 63 | 10·419611 | 10·029365 | 10 8 | 9·970635 | 40 | 10 |
| 30 | 22 | 9·551190 | 11 61 | 10·448810 | 9·580579 | 11 70 | 10·419421 | 10·029389 | 11 9 | 9·970611 | 38 | 30 |
| 51 | 24 | 9·551356 | 12 66 | 10·448644 | 9·580769 | 12 76 | 10·419231 | 10·029414 | 12 10 | 9·970586 | 36 | 9 |
| 30 | 26 | 9·551521 | 13 72 | 10·448479 | 9·580959 | 13 82 | 10·419041 | 10·029438 | 13 10 | 9·970562 | 34 | 30 |
| 52 | 28 | 9·551687 | 14 77 | 10·448313 | 9·581149 | 14 88 | 10·418851 | 10·029462 | 14 11 | 9·970538 | 32 | 8 |
| 30 | 30 | 9·551853 | 15 83 | 10·448147 | 9·581339 | 15 95 | 10·418661 | 10·029486 | 15 12 | 9·970514 | 30 | 30 |
| 53 | 32 | 9·552018 | 16 88 | 10·447982 | 9·581528 | 16 101 | 10·418472 | 10·029510 | 16 13 | 9·970490 | 28 | 7 |
| 30 | 34 | 9·552184 | 17 94 | 10·447816 | 9·581718 | 17 107 | 10·418282 | 10·029534 | 17 14 | 9·970466 | 26 | 30 |
| 54 | 36 | 9·552349 | 18 99 | 10·447651 | 9·581907 | 18 114 | 10·418093 | 10·029558 | 18 14 | 9·970442 | 24 | 6 |
| 30 | 38 | 9·552515 | 19 105 | 10·447485 | 9·582097 | 19 120 | 10·417903 | 10·029582 | 19 15 | 9·970418 | 22 | 30 |
| 55 | 40 | 9·552680 | 20 110 | 10·447320 | 9·582286 | 20 126 | 10·417714 | 10·029606 | 20 16 | 9·970394 | 20 | 5 |
| 30 | 42 | 9·552845 | 21 116 | 10·447155 | 9·582476 | 21 133 | 10·417524 | 10·029630 | 21 17 | 9·970370 | 18 | 30 |
| 56 | 44 | 9·553010 | 22 121 | 10·446990 | 9·582665 | 22 139 | 10·417335 | 10·029655 | 22 18 | 9·970345 | 16 | 4 |
| 30 | 46 | 9·553176 | 23 127 | 10·446824 | 9·582854 | 23 145 | 10·417146 | 10·029679 | 23 18 | 9·970321 | 14 | 30 |
| 57 | 48 | 9·553341 | 24 132 | 10·446659 | 9·583044 | 24 152 | 10·416956 | 10·029703 | 24 19 | 9·970297 | 12 | 3 |
| 30 | 50 | 9·553506 | 25 138 | 10·446494 | 9·583233 | 25 158 | 10·416767 | 10·029727 | 25 20 | 9·970273 | 10 | 30 |
| 58 | 52 | 9·553670 | 26 143 | 10·446330 | 9·583422 | 26 164 | 10·416578 | 10·029751 | 26 21 | 9·970249 | 8 | 2 |
| 30 | 54 | 9·553835 | 27 149 | 10·446165 | 9·583611 | 27 171 | 10·416389 | 10·029776 | 27 22 | 9·970224 | 6 | 30 |
| 59 | 56 | 9·554000 | 28 154 | 10·446000 | 9·583800 | 28 177 | 10·416200 | 10·029800 | 28 22 | 9·970200 | 4 | 1 |
| 30 | 58 | 9·554165 | 29 160 | 10·445835 | 9·583989 | 29 183 | 10·416011 | 10·029824 | 29 23 | 9·970176 | 2 | 30 |
| 60 | **24** | 9·554329 | 30 166 | 10·445671 | 9·584177 | 30 190 | 10·415823 | 10·029848 | 30 24 | 9·970152 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

69° — 4h 36m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

1ʰ 24ᵐ — 21°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·554329 | | 10·445671 | 9·584177 | | 10·415823 | 10·029848 | | 9·970152 | 36 | 60 |
| 30 | 2 | 9·554494 | 1″ 5 | 10·445506 | 9·584366 | 1″ 6 | 10·415634 | 10·029873 | 1″ 1 | 9·970127 | 58 | 30 |
| 1 | 4 | 9·554658 | 2 11 | 10·445342 | 9·584555 | 2 13 | 10·415445 | 10·029897 | 2 2 | 9·970103 | 56 | 59 |
| 30 | 6 | 9·554822 | 3 16 | 10·445178 | 9·584744 | 3 19 | 10·415256 | 10·029921 | 3 2 | 9·970079 | 54 | 30 |
| 2 | 8 | 9·554987 | 4 22 | 10·445013 | 9·584932 | 4 25 | 10·415068 | 10·029945 | 4 3 | 9·970055 | 52 | 58 |
| 30 | 10 | 9·555151 | 5 27 | 10·444849 | 9·585121 | 5 31 | 10·414879 | 10·029970 | 5 4 | 9·970030 | 50 | 30 |
| 3 | 12 | 9·555315 | 6 33 | 10·444685 | 9·585309 | 6 38 | 10·414691 | 10·029994 | 6 5 | 9·970006 | 48 | 57 |
| 30 | 14 | 9·555479 | 7 38 | 10·444521 | 9·585498 | 7 44 | 10·414502 | 10·030018 | 7 6 | 9·969982 | 46 | 30 |
| 4 | 16 | 9·555643 | 8 44 | 10·444357 | 9·585686 | 8 50 | 10·414314 | 10·030043 | 8 7 | 9·969957 | 44 | 56 |
| 30 | 18 | 9·555807 | 9 49 | 10·444193 | 9·585874 | 9 56 | 10·414126 | 10·030067 | 9 7 | 9·969933 | 42 | 30 |
| 5 | 20 | 9·555971 | 10 54 | 10·444029 | 9·586062 | 10 63 | 10·413938 | 10·030091 | 10 8 | 9·969909 | 40 | 55 |
| 30 | 22 | 9·556135 | 11 60 | 10·443865 | 9·586251 | 11 69 | 10·413749 | 10·030116 | 11 9 | 9·969884 | 38 | 30 |
| 6 | 24 | 9·556299 | 12 65 | 10·443701 | 9·586439 | 12 75 | 10·413561 | 10·030140 | 12 10 | 9·969860 | 36 | 54 |
| 30 | 26 | 9·556462 | 13 71 | 10·443538 | 9·586627 | 13 81 | 10·413373 | 10·030164 | 13 11 | 9·969836 | 34 | 30 |
| 7 | 28 | 9·556626 | 14 76 | 10·443374 | 9·586815 | 14 88 | 10·413185 | 10·030189 | 14 11 | 9·969811 | 32 | 53 |
| 30 | 30 | 9·556789 | 15 82 | 10·443211 | 9·587003 | 15 94 | 10·412997 | 10·030213 | 15 12 | 9·969787 | 30 | 30 |
| 8 | 32 | 9·556953 | 16 87 | 10·443047 | 9·587190 | 16 100 | 10·412810 | 10·030238 | 16 13 | 9·969762 | 28 | 52 |
| 30 | 34 | 9·557116 | 17 93 | 10·442884 | 9·587378 | 17 106 | 10·412622 | 10·030262 | 17 14 | 9·969738 | 26 | 30 |
| 9 | 36 | 9·557280 | 18 98 | 10·442720 | 9·587566 | 18 113 | 10·412434 | 10·030286 | 18 15 | 9·969714 | 24 | 51 |
| 30 | 38 | 9·557443 | 19 104 | 10·442557 | 9·587754 | 19 119 | 10·412246 | 10·030311 | 19 15 | 9·969689 | 22 | 30 |
| 10 | 40 | 9·557606 | 20 109 | 10·442394 | 9·587941 | 20 125 | 10·412059 | 10·030335 | 20 16 | 9·969665 | 20 | 50 |
| 30 | 42 | 9·557769 | 21 115 | 10·442231 | 9·588129 | 21 131 | 10·411871 | 10·030360 | 21 17 | 9·969640 | 18 | 30 |
| 11 | 44 | 9·557932 | 22 120 | 10·442068 | 9·588316 | 22 138 | 10·411684 | 10·030384 | 22 18 | 9·969616 | 16 | 49 |
| 30 | 46 | 9·558095 | 23 126 | 10·441905 | 9·588504 | 23 144 | 10·411496 | 10·030409 | 23 19 | 9·969591 | 14 | 30 |
| 12 | 48 | 9·558258 | 24 131 | 10·441742 | 9·588691 | 24 150 | 10·411309 | 10·030433 | 24 19 | 9·969567 | 12 | 48 |
| 30 | 50 | 9·558421 | 25 137 | 10·441579 | 9·588878 | 25 156 | 10·411122 | 10·030458 | 25 20 | 9·969542 | 10 | 30 |
| 13 | 52 | 9·558583 | 26 142 | 10·441417 | 9·589066 | 26 163 | 10·410934 | 10·030482 | 26 21 | 9·969518 | 8 | 47 |
| 30 | 54 | 9·558746 | 27 147 | 10·441254 | 9·589253 | 27 169 | 10·410747 | 10·030507 | 27 22 | 9·969493 | 6 | 30 |
| 14 | 56 | 9·558909 | 28 153 | 10·441091 | 9·589440 | 28 175 | 10·410560 | 10·030531 | 28 23 | 9·969469 | 4 | 46 |
| 30 | 58 | 9·559071 | 29 158 | 10·440929 | 9·589627 | 29 182 | 10·410373 | 10·030556 | 29 23 | 9·969444 | 2 | 30 |
| 15 | 25 | 9·559234 | 30 163 | 10·440766 | 9·589814 | 30 188 | 10·410186 | 10·030580 | 30 24 | 9·969420 | 35 | 45 |
| 30 | 2 | 9·559396 | 1 5 | 10·440604 | 9·590001 | 1 6 | 10·409999 | 10·030605 | 1 1 | 9·969395 | 58 | 30 |
| 16 | 4 | 9·559558 | 2 11 | 10·440442 | 9·590188 | 2 12 | 10·409812 | 10·030630 | 2 2 | 9·969370 | 56 | 44 |
| 30 | 6 | 9·559721 | 3 16 | 10·440279 | 9·590375 | 3 19 | 10·409625 | 10·030654 | 3 2 | 9·969346 | 54 | 30 |
| 17 | 8 | 9·559883 | 4 22 | 10·440117 | 9·590562 | 4 25 | 10·409438 | 10·030679 | 4 3 | 9·969321 | 52 | 43 |
| 30 | 10 | 9·560045 | 5 27 | 10·439955 | 9·590748 | 5 31 | 10·409252 | 10·030703 | 5 4 | 9·969297 | 50 | 30 |
| 18 | 12 | 9·560207 | 6 32 | 10·439793 | 9·590935 | 6 37 | 10·409065 | 10·030728 | 6 5 | 9·969272 | 48 | 42 |
| 30 | 14 | 9·560369 | 7 38 | 10·439631 | 9·591122 | 7 43 | 10·408878 | 10·030753 | 7 6 | 9·969247 | 46 | 39 |
| 19 | 16 | 9·560531 | 8 43 | 10·439469 | 9·591308 | 8 50 | 10·408692 | 10·030777 | 8 7 | 9·969223 | 44 | 41 |
| 30 | 18 | 9·560693 | 9 48 | 10·439307 | 9·591495 | 9 56 | 10·408505 | 10·030802 | 9 7 | 9·969198 | 42 | 30 |
| 20 | 20 | 9·560855 | 10 54 | 10·439145 | 9·591681 | 10 62 | 10·408319 | 10·030827 | 10 8 | 9·969173 | 40 | 40 |
| 30 | 22 | 9·561016 | 11 59 | 10·438984 | 9·591867 | 11 68 | 10·408132 | 10·030851 | 11 9 | 9·969149 | 38 | 30 |
| 21 | 24 | 9·561178 | 12 65 | 10·438822 | 9·592054 | 12 74 | 10·407946 | 10·030876 | 12 10 | 9·969124 | 36 | 39 |
| 30 | 26 | 9·561339 | 13 70 | 10·438661 | 9·592240 | 13 81 | 10·407760 | 10·030901 | 13 11 | 9·969099 | 34 | 30 |
| 22 | 28 | 9·561501 | 14 75 | 10·438499 | 9·592426 | 14 87 | 10·407574 | 10·030925 | 14 11 | 9·969075 | 32 | 38 |
| 30 | 30 | 9·561662 | 15 81 | 10·438338 | 9·592612 | 15 93 | 10·407388 | 10·030950 | 15 12 | 9·969050 | 30 | 30 |
| 23 | 32 | 9·561824 | 16 86 | 10·438176 | 9·592799 | 16 99 | 10·407201 | 10·030975 | 16 13 | 9·969025 | 28 | 37 |
| 30 | 34 | 9·561985 | 17 91 | 10·438015 | 9·592985 | 17 105 | 10·407015 | 10·031000 | 17 14 | 9·969000 | 26 | 30 |
| 24 | 36 | 9·562146 | 18 97 | 10·437854 | 9·593171 | 18 112 | 10·406829 | 10·031024 | 18 15 | 9·968976 | 24 | 36 |
| 30 | 38 | 9·562307 | 19 102 | 10·437693 | 9·593356 | 19 118 | 10·406644 | 10·031049 | 19 16 | 9·968951 | 22 | 30 |
| 25 | 40 | 9·562468 | 20 108 | 10·437532 | 9·593542 | 20 124 | 10·406458 | 10·031074 | 20 16 | 9·968926 | 20 | 35 |
| 30 | 42 | 9·562629 | 21 113 | 10·437371 | 9·593728 | 21 130 | 10·406272 | 10·031099 | 21 17 | 9·968901 | 18 | 30 |
| 26 | 44 | 9·562790 | 22 119 | 10·437210 | 9·593914 | 22 136 | 10·406086 | 10·031123 | 22 18 | 9·968877 | 16 | 34 |
| 30 | 46 | 9·562951 | 23 124 | 10·437049 | 9·594099 | 23 143 | 10·405901 | 10·031148 | 23 19 | 9·968852 | 14 | 30 |
| 27 | 48 | 9·563112 | 24 129 | 10·436888 | 9·594285 | 24 149 | 10·405715 | 10·031173 | 24 20 | 9·968827 | 12 | 33 |
| 30 | 50 | 9·563273 | 25 135 | 10·436727 | 9·594471 | 25 155 | 10·405529 | 10·031198 | 25 20 | 9·968802 | 10 | 30 |
| 28 | 52 | 9·563433 | 26 140 | 10·436567 | 9·594656 | 26 161 | 10·405344 | 10·031223 | 26 21 | 9·968777 | 8 | 32 |
| 30 | 54 | 9·563594 | 27 145 | 10·436406 | 9·594842 | 27 167 | 10·405158 | 10·031248 | 27 22 | 9·968752 | 6 | 30 |
| 29 | 56 | 9·563755 | 28 151 | 10·436245 | 9·595027 | 28 174 | 10·404973 | 10·031272 | 28 23 | 9·968728 | 4 | 31 |
| 30 | 58 | 9·563915 | 29 156 | 10·436085 | 9·595212 | 29 180 | 10·404788 | 10·031297 | 29 24 | 9·968703 | 2 | 30 |
| 30 | 26 | 9·564075 | 30 161 | 10·435925 | 9·595398 | 30 186 | 10·404602 | 10·031322 | 30 25 | 9·968678 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

68° — 4ʰ 34ᵐ

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$1^h\ 26^m$ 21°

| ′ ″ | m. s. | Sine | Parts | Cosec | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·564075 | | 10·435925 | 9·595398 | | 10·404602 | 10·031322 | | 9·968678 | 34 | 30 |
| 30 | 2 | 9·564236 | 1″ 5 | 10·435764 | 9·595583 | 1″ 6 | 10·404417 | 10·031347 | 1″ 1 | 9·968653 | 58 | 30 |
| 31 | 4 | 9·564396 | 2 11 | 10·435604 | 9·595768 | 2 12 | 10·404232 | 10·031372 | 2 2 | 9·968628 | 56 | 29 |
| 30 | 6 | 9·564556 | 3 16 | 10·435444 | 9·595953 | 3 18 | 10·404047 | 10·031397 | 3 3 | 9·968603 | 54 | 30 |
| 32 | 8 | 9·564716 | 4 21 | 10·435284 | 9·596138 | 4 25 | 10·403862 | 10·031422 | 4 3 | 9·968578 | 52 | 28 |
| 30 | 10 | 9·564876 | 5 27 | 10·435124 | 9·596323 | 5 31 | 10·403677 | 10·031447 | 5 4 | 9·968553 | 50 | 30 |
| 33 | 12 | 9·565036 | 6 32 | 10·434964 | 9·596508 | 6 37 | 10·403492 | 10·031472 | 6 5 | 9·968528 | 48 | 27 |
| 30 | 14 | 9·565196 | 7 37 | 10·434804 | 9·596693 | 7 43 | 10·403307 | 10·031497 | 7 6 | 9·968503 | 46 | 30 |
| 34 | 16 | 9·565356 | 8 42 | 10·434644 | 9·596878 | 8 49 | 10·403122 | 10·031521 | 8 7 | 9·968479 | 44 | 26 |
| 30 | 18 | 9·565516 | 9 48 | 10·434484 | 9·597062 | 9 55 | 10·402938 | 10·031546 | 9 8 | 9·968454 | 42 | 30 |
| 35 | 20 | 9·565676 | 10 53 | 10·434324 | 9·597247 | 10 61 | 10·402753 | 10·031571 | 10 8 | 9·968429 | 40 | 25 |
| 30 | 22 | 9·565835 | 11 58 | 10·434165 | 9·597432 | 11 68 | 10·402568 | 10·031596 | 11 9 | 9·968404 | 38 | 30 |
| 36 | 24 | 9·565995 | 12 64 | 10·434005 | 9·597616 | 12 74 | 10·402384 | 10·031621 | 12 10 | 9·968379 | 36 | 24 |
| 30 | 26 | 9·566154 | 13 69 | 10·433846 | 9·597801 | 13 80 | 10·402199 | 10·031646 | 13 11 | 9·968354 | 34 | 30 |
| 37 | 28 | 9·566314 | 14 74 | 10·433686 | 9·597985 | 14 86 | 10·402015 | 10·031671 | 14 12 | 9·968329 | 32 | 23 |
| 30 | 30 | 9·566473 | 15 80 | 10·433527 | 9·598170 | 15 92 | 10·401830 | 10·031697 | 15 12 | 9·968303 | 30 | 30 |
| 38 | 32 | 9·566632 | 16 85 | 10·433368 | 9·598354 | 16 98 | 10·401646 | 10·031722 | 16 13 | 9·968278 | 28 | 22 |
| 30 | 34 | 9·566792 | 17 90 | 10·433208 | 9·598538 | 17 105 | 10·401462 | 10·031747 | 17 14 | 9·968253 | 26 | 30 |
| 39 | 36 | 9·566951 | 18 96 | 10·433049 | 9·598722 | 18 111 | 10·401278 | 10·031772 | 18 15 | 9·968228 | 24 | 21 |
| 30 | 38 | 9·567110 | 19 101 | 10·432890 | 9·598907 | 19 117 | 10·401093 | 10·031797 | 19 16 | 9·968203 | 22 | 30 |
| 40 | 40 | 9·567269 | 20 106 | 10·432731 | 9·599091 | 20 123 | 10·400909 | 10·031822 | 20 17 | 9·968178 | 20 | 20 |
| 30 | 42 | 9·567428 | 21 112 | 10·432572 | 9·599275 | 21 129 | 10·400725 | 10·031847 | 21 17 | 9·968153 | 18 | 30 |
| 41 | 44 | 9·567587 | 22 117 | 10·432413 | 9·599459 | 22 135 | 10·400541 | 10·031872 | 22 18 | 9·968128 | 16 | 19 |
| 30 | 46 | 9·567746 | 23 122 | 10·432254 | 9·599643 | 23 141 | 10·400357 | 10·031897 | 23 19 | 9·968103 | 14 | 30 |
| 42 | 48 | 9·567904 | 24 127 | 10·432096 | 9·599827 | 24 148 | 10·400173 | 10·031922 | 24 20 | 9·968078 | 12 | 18 |
| 30 | 50 | 9·568063 | 25 133 | 10·431937 | 9·600011 | 25 154 | 10·399989 | 10·031947 | 25 21 | 9·968053 | 10 | 30 |
| 43 | 52 | 9·568222 | 26 138 | 10·431778 | 9·600194 | 26 160 | 10·399806 | 10·031973 | 26 22 | 9·968027 | 8 | 17 |
| 30 | 54 | 9·568380 | 27 143 | 10·431620 | 9·600378 | 27 166 | 10·399622 | 10·031998 | 27 22 | 9·968002 | 6 | 30 |
| 44 | 56 | 9·568539 | 28 149 | 10·431461 | 9·600562 | 28 172 | 10·399438 | 10·032023 | 28 23 | 9·967977 | 4 | 16 |
| 30 | 58 | 9·568697 | 29 154 | 10·431303 | 9·600745 | 29 178 | 10·399255 | 10·032048 | 29 24 | 9·967952 | 2 | 30 |
| 45 | 27 | 9·568856 | 30 159 | 10·431144 | 9·600929 | 30 184 | 10·399071 | 10·032073 | 30 25 | 9·967927 | 33 | 15 |
| 30 | 2 | 9·569014 | 1 5 | 10·430986 | 9·601112 | 1 6 | 10·398888 | 10·032099 | 1 1 | 9·967901 | 58 | 30 |
| 46 | 4 | 9·569172 | 2 10 | 10·430828 | 9·601296 | 2 12 | 10·398704 | 10·032124 | 2 2 | 9·967876 | 56 | 14 |
| 30 | 6 | 9·569330 | 3 16 | 10·430670 | 9·601479 | 3 18 | 10·398521 | 10·032149 | 3 3 | 9·967851 | 54 | 30 |
| 47 | 8 | 9·569488 | 4 21 | 10·430512 | 9·601663 | 4 24 | 10·398337 | 10·032174 | 4 3 | 9·967826 | 52 | 13 |
| 30 | 10 | 9·569646 | 5 26 | 10·430354 | 9·601846 | 5 30 | 10·398154 | 10·032199 | 5 4 | 9·967801 | 50 | 30 |
| 48 | 12 | 9·569804 | 6 31 | 10·430196 | 9·602029 | 6 37 | 10·397971 | 10·032225 | 6 5 | 9·967775 | 48 | 12 |
| 30 | 14 | 9·569962 | 7 37 | 10·430038 | 9·602212 | 7 43 | 10·397788 | 10·032250 | 7 6 | 9·967750 | 46 | 30 |
| 49 | 16 | 9·570120 | 8 42 | 10·429880 | 9·602395 | 8 49 | 10·397605 | 10·032275 | 8 7 | 9·967725 | 44 | 11 |
| 30 | 18 | 9·570278 | 9 47 | 10·429722 | 9·602578 | 9 55 | 10·397422 | 10·032301 | 9 8 | 9·967699 | 42 | 30 |
| 50 | 20 | 9·570435 | 10 52 | 10·429565 | 9·602761 | 10 61 | 10·397239 | 10·032326 | 10 8 | 9·967674 | 40 | 10 |
| 30 | 22 | 9·570593 | 11 58 | 10·429407 | 9·602944 | 11 67 | 10·397056 | 10·032351 | 11 9 | 9·967649 | 38 | 30 |
| 51 | 24 | 9·570751 | 12 63 | 10·429249 | 9·603127 | 12 73 | 10·396873 | 10·032376 | 12 10 | 9·967624 | 36 | 9 |
| 30 | 26 | 9·570908 | 13 68 | 10·429092 | 9·603310 | 13 79 | 10·396690 | 10·032402 | 13 11 | 9·967598 | 34 | 30 |
| 52 | 28 | 9·571066 | 14 73 | 10·428934 | 9·603493 | 14 85 | 10·396507 | 10·032427 | 14 12 | 9·967573 | 32 | 8 |
| 30 | 30 | 9·571223 | 15 79 | 10·428777 | 9·603675 | 15 91 | 10·396325 | 10·032453 | 15 13 | 9·967547 | 30 | 30 |
| 53 | 32 | 9·571380 | 16 84 | 10·428620 | 9·603858 | 16 97 | 10·396142 | 10·032478 | 16 14 | 9·967522 | 28 | 7 |
| 30 | 34 | 9·571537 | 17 89 | 10·428463 | 9·604041 | 17 104 | 10·395959 | 10·032503 | 17 14 | 9·967497 | 26 | 30 |
| 54 | 36 | 9·571695 | 18 95 | 10·428305 | 9·604223 | 18 110 | 10·395777 | 10·032529 | 18 15 | 9·967471 | 24 | 6 |
| 30 | 38 | 9·571852 | 19 100 | 10·428148 | 9·604406 | 19 116 | 10·395594 | 10·032554 | 19 16 | 9·967446 | 22 | 30 |
| 55 | 40 | 9·572009 | 20 105 | 10·427991 | 9·604588 | 20 122 | 10·395412 | 10·032579 | 20 17 | 9·967421 | 20 | 5 |
| 30 | 42 | 9·572166 | 21 110 | 10·427834 | 9·604771 | 21 128 | 10·395229 | 10·032605 | 21 18 | 9·967395 | 18 | 30 |
| 56 | 44 | 9·572323 | 22 116 | 10·427677 | 9·604953 | 22 134 | 10·395047 | 10·032630 | 22 19 | 9·967370 | 16 | 4 |
| 30 | 46 | 9·572479 | 23 121 | 10·427521 | 9·605135 | 23 140 | 10·394865 | 10·032656 | 23 20 | 9·967344 | 14 | 30 |
| 57 | 48 | 9·572636 | 24 126 | 10·427364 | 9·605317 | 24 146 | 10·394683 | 10·032681 | 24 20 | 9·967319 | 12 | 3 |
| 30 | 50 | 9·572793 | 25 131 | 10·427207 | 9·605500 | 25 152 | 10·394500 | 10·032707 | 25 21 | 9·967293 | 10 | 30 |
| 58 | 52 | 9·572950 | 26 137 | 10·427050 | 9·605682 | 26 158 | 10·394318 | 10·032732 | 26 22 | 9·967268 | 8 | 2 |
| 30 | 54 | 9·573106 | 27 142 | 10·426894 | 9·605864 | 27 164 | 10·394136 | 10·032758 | 27 23 | 9·967242 | 6 | 30 |
| 59 | 56 | 9·573263 | 28 147 | 10·426737 | 9·606046 | 28 171 | 10·393954 | 10·032783 | 28 24 | 9·967217 | 4 | 1 |
| 30 | 58 | 9·573419 | 29 152 | 10·426581 | 9·606228 | 29 177 | 10·393772 | 10·032809 | 29 25 | 9·967191 | 2 | 30 |
| 60 | 28 | 9·573575 | 30 157 | 10·426425 | 9·606410 | 30 183 | 10·393590 | 10·032834 | 30 25 | 9·967166 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

68° $4^h\ 32^m$

TABLE XXVI.—(*continued*).

**LOG. SINES, COSINES, &c.**

1ʰ 28ᵐ — 22°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·573575 | | 10·426425 | 9·606410 | | 10·393590 | 10·032834 | | 9·967166 | **32** | 60 |
| 30 | 2 | 9·573732 | 1″ 5 | 10·426268 | 9·606591 | 1″ 6 | 10·393409 | 10·032860 | 1″ 1 | 9·967140 | 58 | 30 |
| 1 | 4 | 9·573888 | 2 10 | 10·426112 | 9·606773 | 2 12 | 10·393227 | 10·032885 | 2 2 | 9·967115 | 56 | 59 |
| 30 | 6 | 9·574044 | 3 16 | 10·425956 | 9·606955 | 3 18 | 10·393045 | 10·032911 | 3 3 | 9·967089 | 54 | 30 |
| 2 | 8 | 9·574200 | 4 21 | 10·425800 | 9·607137 | 4 24 | 10·392863 | 10·032936 | 4 3 | 9·967064 | 52 | 58 |
| 30 | 10 | 9·574356 | 5 26 | 10·425644 | 9·607318 | 5 30 | 10·392682 | 10·032962 | 5 4 | 9·967038 | 50 | 30 |
| 3 | 12 | 9·574512 | 6 31 | 10·425488 | 9·607500 | 6 36 | 10·392500 | 10·032987 | 6 5 | 9·967013 | 48 | 57 |
| 30 | 14 | 9·574668 | 7 36 | 10·425332 | 9·607681 | 7 42 | 10·392319 | 10·033013 | 7 6 | 9·966987 | 46 | 30 |
| 4 | 16 | 9·574824 | 8 41 | 10·425176 | 9·607863 | 8 48 | 10·392137 | 10·033039 | 8 7 | 9·966961 | 44 | 56 |
| 30 | 18 | 9·574980 | 9 47 | 10·425020 | 9·608044 | 9 54 | 10·391956 | 10·033064 | 9 8 | 9·966936 | 42 | 30 |
| 5 | 20 | 9·575136 | 10 52 | 10·424864 | 9·608225 | 10 60 | 10·391775 | 10·033090 | 10 9 | 9·966910 | 40 | 55 |
| 30 | 22 | 9·575291 | 11 57 | 10·424709 | 9·608407 | 11 66 | 10·391593 | 10·033116 | 11 9 | 9·966884 | 38 | 30 |
| 6 | 24 | 9·575447 | 12 62 | 10·424553 | 9·608588 | 12 72 | 10·391412 | 10·033141 | 12 10 | 9·966859 | 36 | 54 |
| 30 | 26 | 9·575602 | 13 67 | 10·424398 | 9·608769 | 13 78 | 10·391231 | 10·033167 | 13 11 | 9·966833 | 34 | 30 |
| 7 | 28 | 9·375758 | 14 73 | 10·424242 | 9·608950 | 14 84 | 10·391050 | 10·033192 | 14 12 | 9·966808 | 32 | 53 |
| 30 | 30 | 9·575913 | 15 78 | 10·424087 | 9·609131 | 15 90 | 10·390869 | 10·033218 | 15 13 | 9·966782 | 30 | 30 |
| 8 | 32 | 9·576069 | 16 83 | 10·423931 | 9·609312 | 16 96 | 10·390688 | 10·033244 | 16 14 | 9·966756 | 28 | 52 |
| 30 | 34 | 9·576224 | 17 88 | 10·423776 | 9·609493 | 17 103 | 10·390507 | 10·033270 | 17 14 | 9·966730 | 26 | 30 |
| 9 | 36 | 9·576379 | 13 93 | 10·423621 | 9·609674 | 18 109 | 10·390326 | 10·033295 | 18 15 | 9·966705 | 24 | 51 |
| 30 | 38 | 9·576534 | 19 99 | 10·423466 | 9·609855 | 19 115 | 10·390145 | 10·033321 | 19 16 | 9·966679 | 22 | 30 |
| 10 | 40 | 9·576689 | 20 104 | 10·423311 | 9·610036 | 20 121 | 10·389964 | 10·033347 | 20 17 | 9·966653 | 20 | 50 |
| 30 | 42 | 9·576844 | 21 109 | 10·423156 | 9·610217 | 21 127 | 10·389783 | 10·033372 | 21 18 | 9·966628 | 18 | 30 |
| 11 | 44 | 9·576999 | 22 114 | 10·423001 | 9·610397 | 22 133 | 10·389603 | 10·033398 | 22 19 | 9·966602 | 16 | 49 |
| 30 | 46 | 9·577154 | 23 119 | 10·422846 | 9·610578 | 23 139 | 10·389422 | 10·033424 | 23 20 | 9·966576 | 14 | 30 |
| 12 | 48 | 9·577309 | 24 124 | 10·422691 | 9·610759 | 24 145 | 10·389241 | 10·033450 | 24 21 | 9·966550 | 12 | 48 |
| 30 | 50 | 9·577464 | 25 130 | 10·422536 | 9·610939 | 25 151 | 10·389061 | 10·033475 | 25 21 | 9·966525 | 10 | 30 |
| 13 | 52 | 9·577618 | 26 135 | 10·422382 | 9·611120 | 26 157 | 10·388880 | 10·033501 | 26 22 | 9·966499 | 8 | 47 |
| 30 | 54 | 9·577773 | 27 140 | 10·422227 | 9·611300 | 27 163 | 10·388700 | 10·033527 | 27 23 | 9·966473 | 6 | 30 |
| 14 | 56 | 9·577927 | 28 145 | 10·422073 | 9·611480 | 28 169 | 10·388520 | 10·033553 | 28 24 | 9·966447 | 4 | 46 |
| 30 | 58 | 9·578082 | 29 150 | 10·421918 | 9·611661 | 29 175 | 10·388339 | 10·033579 | 29 25 | 9·966421 | 2 | 30 |
| 15 | **29** | 9·578236 | 30 155 | 10·421764 | 9·611841 | 30 181 | 10·388159 | 10·033605 | 30 26 | 9·966395 | **31** | 45 |
| 30 | 2 | 9·578391 | 1 5 | 10·421609 | 9·612021 | 1 6 | 10·387979 | 10·033630 | 1 1 | 9·966370 | 58 | 30 |
| 16 | 4 | 9·578545 | 2 10 | 10·421455 | 9·612201 | 2 12 | 10·387799 | 10·033656 | 2 2 | 9·966344 | 56 | 44 |
| 30 | 6 | 9·578699 | 3 15 | 10·421301 | 9·612381 | 3 18 | 10·387619 | 10·033682 | 3 3 | 9·966318 | 54 | 30 |
| 17 | 8 | 9·578853 | 4 20 | 10·421147 | 9·612561 | 4 24 | 10·387439 | 10·033708 | 4 3 | 9·966292 | 52 | 43 |
| 30 | 10 | 9·579008 | 5 26 | 10·420992 | 9·612741 | 5 30 | 10·387259 | 10·033734 | 5 4 | 9·966266 | 50 | 30 |
| 18 | 12 | 9·579162 | 6 31 | 10·420838 | 9·612921 | 6 36 | 10·387079 | 10·033760 | 6 5 | 9·966240 | 48 | 42 |
| 30 | 14 | 9·579316 | 7 36 | 10·420684 | 9·613101 | 7 42 | 10·386899 | 10·033786 | 7 6 | 9·966214 | 46 | 30 |
| 19 | 16 | 9·579470 | 8 41 | 10·420530 | 9·613281 | 8 48 | 10·386719 | 10·033812 | 8 7 | 9·966188 | 44 | 41 |
| 30 | 18 | 9·579623 | 9 46 | 10·420377 | 9·613461 | 9 54 | 10·386539 | 10·033838 | 9 8 | 9·966162 | 42 | 30 |
| 20 | 20 | 9·579777 | 10 51 | 10·420223 | 9·613641 | 10 60 | 10·386359 | 10·033864 | 10 9 | 9·966136 | 40 | 40 |
| 30 | 22 | 9·579931 | 11 56 | 10·420069 | 9·613820 | 11 66 | 10·386180 | 10·033890 | 11 10 | 9·966110 | 38 | 30 |
| 21 | 24 | 9·580085 | 12 61 | 10·419915 | 9·614000 | 12 72 | 10·386000 | 10·033915 | 12 10 | 9·966085 | 36 | 39 |
| 30 | 26 | 9·580238 | 13 66 | 10·419762 | 9·614180 | 13 78 | 10·385820 | 10·033941 | 13 11 | 9·966059 | 34 | 30 |
| 22 | 28 | 9·580392 | 14 71 | 10·419608 | 9·614359 | 14 84 | 10·385641 | 10·033967 | 14 12 | 9·966033 | 32 | 38 |
| 30 | 30 | 9·580545 | 15 77 | 10·419455 | 9·614539 | 15 90 | 10·385461 | 10·033993 | 15 13 | 9·966007 | 30 | 30 |
| 23 | 32 | 9·580699 | 16 82 | 10·419301 | 9·614718 | 16 96 | 10·385282 | 10·034019 | 16 14 | 9·965981 | 28 | 37 |
| 30 | 34 | 9·580852 | 17 87 | 10·419148 | 9·614897 | 17 102 | 10·385103 | 10·034045 | 17 15 | 9·965955 | 26 | 30 |
| 24 | 36 | 9·581005 | 18 92 | 10·418995 | 9·615077 | 18 108 | 10·384923 | 10·034071 | 18 16 | 9·965929 | 24 | 36 |
| 30 | 38 | 9·581158 | 19 97 | 10·418842 | 9·615256 | 19 114 | 10·384744 | 10·034098 | 19 17 | 9·965902 | 22 | 30 |
| 25 | 40 | 9·581312 | 20 102 | 10·418688 | 9·615435 | 20 120 | 10·384565 | 10·034124 | 20 17 | 9·965876 | 20 | 35 |
| 30 | 42 | 9·581465 | 21 107 | 10·418535 | 9·615614 | 21 126 | 10·384386 | 10·034150 | 21 18 | 9·965850 | 18 | 30 |
| 26 | 44 | 9·581618 | 22 112 | 10·418382 | 9·615793 | 22 132 | 10·384207 | 10·034176 | 22 19 | 9·965824 | 16 | 34 |
| 30 | 46 | 9·581771 | 23 118 | 10·418229 | 9·615972 | 23 138 | 10·384028 | 10·034202 | 23 20 | 9·965798 | 14 | 30 |
| 27 | 48 | 9·581924 | 24 123 | 10·418076 | 9·616151 | 24 144 | 10·383849 | 10·034228 | 24 21 | 9·965772 | 12 | 33 |
| 30 | 50 | 9·582076 | 25 128 | 10·417924 | 9·616330 | 25 149 | 10·383670 | 10·034254 | 25 22 | 9·965746 | 10 | 30 |
| 28 | 52 | 9·582229 | 26 133 | 10·417771 | 9·616509 | 26 155 | 10·383491 | 10·034280 | 26 23 | 9·965720 | 8 | 32 |
| 30 | 54 | 9·582382 | 27 138 | 10·417618 | 9·616688 | 27 161 | 10·383312 | 10·034306 | 27 23 | 9·965694 | 6 | 30 |
| 29 | 56 | 9·582535 | 28 143 | 10·417465 | 9·616867 | 28 167 | 10·383133 | 10·034332 | 28 24 | 9·965668 | 4 | 31 |
| 30 | 58 | 9·582687 | 29 148 | 10·417313 | 9·617046 | 29 173 | 10·382954 | 10·034358 | 29 25 | 9·965642 | 2 | 30 |
| 30 | **30** | 9·582840 | 30 153 | 10·417160 | 9·617224 | 30 179 | 10·382776 | 10·034385 | 30 26 | 9·965615 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |

67° — 4ʰ 30ᵐ

TABLE XXVI.—(*continued*).

**LOG. SINES, COSINES, &c.**

1ʰ 30ᵐ — 22°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·582840 | | 10·417160 | 9·617224 | | 10·382776 | 10·034385 | | 9·965615 | 30 | 30 |
| 30 | 2 | 9·582992 | 1″ 5 | 10·417008 | 9·617403 | 1″ 6 | 10·382597 | 10·034411 | 1″ 1 | 9·965589 | 58 | 30 |
| 31 | 4 | 9·583145 | 2 10 | 10·416855 | 9·617582 | 2 12 | 10·382418 | 10·034437 | 2 2 | 9·965563 | 56 | 29 |
| 30 | 6 | 9·583297 | 3 15 | 10·416703 | 9·617760 | 3 18 | 10·382240 | 10·034463 | 3 3 | 9·965537 | 54 | 30 |
| 32 | 8 | 9·583449 | 4 20 | 10·416551 | 9·617939 | 4 24 | 10·382061 | 10·034489 | 4 4 | 9·965511 | 52 | 28 |
| 30 | 10 | 9·583601 | 5 25 | 10·416399 | 9·618117 | 5 30 | 10·381883 | 10·034516 | 5 4 | 9·965484 | 50 | 30 |
| 33 | 12 | 9·583754 | 6 30 | 10·416246 | 9·618295 | 6 36 | 10·381705 | 10·034542 | 6 5 | 9·965458 | 48 | 27 |
| 30 | 14 | 9·583906 | 7 35 | 10·416094 | 9·618474 | 7 42 | 10·381526 | 10·034568 | 7 6 | 9·965432 | 46 | 30 |
| 34 | 16 | 9·584058 | 8 40 | 10·415942 | 9·618652 | 8 47 | 10·381348 | 10·034594 | 8 7 | 9·965406 | 44 | 26 |
| 30 | 18 | 9·584210 | 9 45 | 10·415790 | 9·618830 | 9 53 | 10·381170 | 10·034621 | 9 8 | 9·965379 | 42 | 30 |
| 35 | 20 | 9·584361 | 10 50 | 10·415639 | 9·619008 | 10 59 | 10·380992 | 10·034647 | 10 9 | 9·965353 | 40 | 25 |
| 30 | 22 | 9·584513 | 11 56 | 10·415487 | 9·619186 | 11 65 | 10·380814 | 10·034673 | 11 10 | 9·965327 | 38 | 30 |
| 36 | 24 | 9·584665 | 12 61 | 10·415335 | 9·619364 | 12 71 | 10·380636 | 10·034699 | 12 11 | 9·965301 | 36 | 24 |
| 30 | 26 | 9·584817 | 13 66 | 10·415183 | 9·619543 | 13 77 | 10·380457 | 10·034726 | 13 11 | 9·965274 | 34 | 30 |
| 37 | 28 | 9·584968 | 14 71 | 10·415032 | 9·619720 | 14 83 | 10·380280 | 10·034752 | 14 12 | 9·965248 | 32 | 23 |
| 30 | 30 | 9·585120 | 15 76 | 10·414880 | 9·619898 | 15 90 | 10·380102 | 10·034778 | 15 13 | 9·965222 | 30 | 30 |
| 38 | 32 | 9·585272 | 16 81 | 10·414728 | 9·620076 | 16 95 | 10·379924 | 10·034805 | 16 14 | 9·965195 | 28 | 22 |
| 30 | 34 | 9·585423 | 17 86 | 10·414577 | 9·620254 | 17 101 | 10·379746 | 10·034831 | 17 15 | 9·965169 | 26 | 30 |
| 39 | 36 | 9·585574 | 18 91 | 10·414426 | 9·620432 | 18 107 | 10·379568 | 10·034857 | 18 16 | 9·965143 | 24 | 21 |
| 30 | 38 | 9·585726 | 19 96 | 10·414274 | 9·620610 | 19 113 | 10·379390 | 10·034884 | 19 17 | 9·965116 | 22 | 30 |
| 40 | 40 | 9·585877 | 20 101 | 10·414123 | 9·620787 | 20 119 | 10·379213 | 10·034910 | 20 18 | 9·965090 | 20 | 20 |
| 30 | 42 | 9·586028 | 21 106 | 10·413972 | 9·620965 | 21 125 | 10·379035 | 10·034936 | 21 18 | 9·965064 | 18 | 30 |
| 41 | 44 | 9·586179 | 22 111 | 10·413821 | 9·621142 | 22 130 | 10·378858 | 10·034963 | 22 19 | 9·965037 | 16 | 19 |
| 30 | 46 | 9·586331 | 23 116 | 10·413669 | 9·621320 | 23 136 | 10·378680 | 10·034989 | 23 20 | 9·965011 | 14 | 30 |
| 42 | 48 | 9·586482 | 24 121 | 10·413518 | 9·621497 | 24 142 | 10·378503 | 10·035016 | 24 21 | 9·964984 | 12 | 18 |
| 30 | 50 | 9·586633 | 25 126 | 10·413367 | 9·621675 | 25 148 | 10·378325 | 10·035042 | 25 22 | 9·964958 | 10 | 30 |
| 43 | 52 | 9·586783 | 26 131 | 10·413217 | 9·621852 | 26 154 | 10·378148 | 10·035069 | 26 23 | 9·964931 | 8 | 17 |
| 30 | 54 | 9·586934 | 27 136 | 10·413066 | 9·622029 | 27 160 | 10·377971 | 10·035095 | 27 24 | 9·964905 | 6 | 30 |
| 44 | 56 | 9·587085 | 28 141 | 10·412915 | 9·622207 | 28 166 | 10·377793 | 10·035121 | 28 25 | 9·964879 | 4 | 16 |
| 30 | 58 | 9·587236 | 29 146 | 10·412764 | 9·622384 | 29 172 | 10·377616 | 10·035148 | 29 26 | 9·964852 | 2 | 30 |
| 45 | **31** | 9·587386 | 30 151 | 10·412614 | 9·622561 | 30 178 | 10·377439 | 10·035174 | 30 26 | 9·964826 | **29** | 15 |
| 30 | 2 | 9·587537 | 1 5 | 10·412463 | 9·622738 | 1 6 | 10·377262 | 10·035201 | 1 1 | 9·964799 | 58 | 30 |
| 46 | 4 | 9·587688 | 2 10 | 10·412312 | 9·622915 | 2 12 | 10·377085 | 10·035227 | 2 2 | 9·964773 | 56 | 14 |
| 30 | 6 | 9·587838 | 3 15 | 10·412162 | 9·623092 | 3 18 | 10·376908 | 10·035254 | 3 3 | 9·964746 | 54 | 30 |
| 47 | 8 | 9·587989 | 4 20 | 10·412011 | 9·623269 | 4 24 | 10·376731 | 10·035280 | 4 4 | 9·964720 | 52 | 13 |
| 30 | 10 | 9·588139 | 5 25 | 10·411861 | 9·623446 | 5 29 | 10·376554 | 10·035307 | 5 4 | 9·964693 | 50 | 30 |
| 48 | 12 | 9·588289 | 6 30 | 10·411711 | 9·623623 | 6 35 | 10·376377 | 10·035334 | 6 5 | 9·964666 | 48 | 12 |
| 30 | 14 | 9·588439 | 7 35 | 10·411561 | 9·623800 | 7 41 | 10·376200 | 10·035360 | 7 6 | 9·964640 | 46 | 30 |
| 49 | 16 | 9·588590 | 8 40 | 10·411410 | 9·623976 | 8 47 | 10·376024 | 10·035387 | 8 7 | 9·964613 | 44 | 11 |
| 30 | 18 | 9·588740 | 9 45 | 10·411260 | 9·624153 | 9 53 | 10·375847 | 10·035413 | 9 8 | 9·964587 | 42 | 30 |
| 50 | 20 | 9·588890 | 10 50 | 10·411110 | 9·624330 | 10 59 | 10·375670 | 10·035440 | 10 9 | 9·964560 | 40 | 10 |
| 30 | 22 | 9·589040 | 11 55 | 10·410960 | 9·624506 | 11 65 | 10·375494 | 10·035466 | 11 10 | 9·964534 | 38 | 30 |
| 51 | 24 | 9·589190 | 12 60 | 10·410810 | 9·624683 | 12 71 | 10·375317 | 10·035493 | 12 11 | 9·964507 | 36 | 9 |
| 30 | 26 | 9·589340 | 13 65 | 10·410660 | 9·624859 | 13 76 | 10·375141 | 10·035520 | 13 12 | 9·964480 | 34 | 30 |
| 52 | 28 | 9·589489 | 14 70 | 10·410511 | 9·625036 | 14 82 | 10·374964 | 10·035546 | 14 12 | 9·964454 | 32 | 8 |
| 30 | 30 | 9·589639 | 15 75 | 10·410361 | 9·625212 | 15 88 | 10·374788 | 10·035573 | 15 13 | 9·964427 | 30 | 30 |
| 53 | 32 | 9·589789 | 16 80 | 10·410211 | 9·625388 | 16 94 | 10·374612 | 10·035600 | 16 14 | 9·964400 | 28 | 7 |
| 30 | 34 | 9·589938 | 17 85 | 10·410062 | 9·625565 | 17 100 | 10·374435 | 10·035626 | 17 15 | 9·964374 | 26 | 30 |
| 54 | 36 | 9·590088 | 18 90 | 10·409912 | 9·625741 | 18 106 | 10·374259 | 10·035653 | 18 16 | 9·964347 | 24 | 6 |
| 30 | 38 | 9·590237 | 19 95 | 10·409763 | 9·625917 | 19 112 | 10·374083 | 10·035680 | 19 17 | 9·964320 | 22 | 30 |
| 55 | 40 | 9·590387 | 20 100 | 10·409613 | 9·626093 | 20 118 | 10·373907 | 10·035706 | 20 18 | 9·964294 | 20 | 5 |
| 30 | 42 | 9·590536 | 21 105 | 10·409464 | 9·626269 | 21 123 | 10·373731 | 10·035733 | 21 19 | 9·964267 | 18 | 30 |
| 56 | 44 | 9·590686 | 22 110 | 10·409314 | 9·626445 | 22 129 | 10·373555 | 10·035760 | 22 20 | 9·964240 | 16 | 4 |
| 30 | 46 | 9·590835 | 23 115 | 10·409165 | 9·626621 | 23 135 | 10·373379 | 10·035786 | 23 20 | 9·964214 | 14 | 30 |
| 57 | 48 | 9·590984 | 24 120 | 10·409016 | 9·626797 | 24 141 | 10·373203 | 10·035813 | 24 21 | 9·964187 | 12 | 3 |
| 30 | 50 | 9·591133 | 25 125 | 10·408867 | 9·626973 | 25 147 | 10·373027 | 10·035840 | 25 22 | 9·964160 | 10 | 30 |
| 58 | 52 | 9·591282 | 26 130 | 10·408718 | 9·627149 | 26 153 | 10·372851 | 10·035867 | 26 23 | 9·964133 | 8 | 2 |
| 20 | 54 | 9·591431 | 27 135 | 10·408569 | 9·627325 | 27 159 | 10·372675 | 10·035894 | 27 24 | 9·964106 | 6 | 30 |
| 59 | 56 | 9·591580 | 28 140 | 10·408420 | 9·627501 | 28 165 | 10·372499 | 10·035920 | 28 25 | 9·964080 | 4 | 1 |
| 30 | 58 | 9·591729 | 29 145 | 10·408271 | 9·627676 | 29 171 | 10·372324 | 10·035947 | 29 26 | 9·964053 | 2 | 30 |
| 60 | **32** | 9·591878 | 30 150 | 10·408122 | 9·627852 | 30 176 | 10·372148 | 10·035974 | 30 27 | 9·964026 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

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TABLE XXVI.—(*continued*).

| LOG. SINES, COSINES, &c. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1ʰ 32ᵐ | | | | | | 23° | | | | | | |
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 0 | 0 | 9·591878 | | 10·408122 | 9·627852 | | 10·372148 | 10·035974 | | 9·964026 | **28** | 60 |
| 30 | 2 | 9·592027 | 1″ 5 | 10·407973 | 9·628028 | 1″ 6 | 10·371972 | 10·036001 | 1″ 1 | 9·963999 | 58 | 30 |
| 1 | 4 | 9·592176 | 2 10 | 10·407824 | 9·628203 | 2 12 | 10·371797 | 10·036028 | 2 2 | 9·963972 | 56 | 59 |
| 30 | 6 | 9·592324 | 3 15 | 10·407676 | 9·628379 | 3 17 | 10 371621 | 10·036054 | 3 3 | 9·963946 | 54 | 30 |
| 2 | 8 | 9·592473 | 4 20 | 10·407527 | 9·628554 | 4 23 | 10·371446 | 10·036081 | 4 4 | 9·963919 | 52 | 58 |
| 30 | 10 | 9·592621 | 5 25 | 10·407379 | 9·628729 | 5 29 | 10·371271 | 10·036108 | 5 4 | 9·963892 | 50 | 30 |
| 3 | 12 | 9·592770 | 6 30 | 10·407230 | 9·628905 | 6 35 | 10·371095 | 10·036135 | 6 5 | 9·963865 | 48 | 57 |
| 30 | 14 | 9·592918 | 7 35 | 10·407082 | 9·629080 | 7 41 | 10·370920 | 10·036162 | 7 6 | 9·963838 | 46 | 30 |
| 4 | 16 | 9·593067 | 8 39 | 10·406933 | 9·629255 | 8 47 | 10·370745 | 10·036189 | 8 7 | 9·963811 | 44 | 56 |
| 30 | 18 | 9·593215 | 9 44 | 10·406785 | 9·629431 | 9 52 | 10·370569 | 10·036216 | 9 8 | 9·963784 | 42 | 30 |
| 5 | 20 | 9·593363 | 10 49 | 10·406637 | 9·629606 | 10 58 | 10·370394 | 10·036243 | 10 9 | 9·963757 | 40 | 55 |
| 30 | 22 | 9·593511 | 11 54 | 10·406489 | 9·629781 | 11 64 | 10·370219 | 10·036270 | 11 10 | 9·963730 | 38 | 30 |
| 6 | 24 | 9·593659 | 12 59 | 10·406341 | 9·629956 | 12 70 | 10·370044 | 10·036296 | 12 11 | 9·963704 | 36 | 54 |
| 30 | 26 | 9·593807 | 13 64 | 10·406193 | 9·630131 | 13 76 | 10·369869 | 10·036323 | 13 12 | 9·963677 | 34 | 30 |
| 7 | 28 | 9·593955 | 14 69 | 10·406045 | 9·630306 | 14 82 | 10·369694 | 10·036350 | 14 13 | 9·963650 | 32 | 53 |
| 30 | 30 | 9·594103 | 15 74 | 10·405897 | 9·630481 | 15 87 | 10·369519 | 10·036377 | 15 13 | 9·963623 | 30 | 30 |
| 8 | 32 | 9·594251 | 16 79 | 10·405749 | 9·630656 | 16 93 | 10·369344 | 10·036404 | 16 14 | 9·963596 | 28 | 52 |
| 30 | 34 | 9·594399 | 17 84 | 10·405601 | 9·630830 | 17 99 | 10·369170 | 10·036431 | 17 15 | 9·963569 | 26 | 30 |
| 9 | 36 | 9·594547 | 18 89 | 10·405453 | 9·631005 | 18 105 | 10·368995 | 10·036458 | 18 16 | 9·963542 | 24 | 51 |
| 30 | 38 | 9·594695 | 19 94 | 10·405305 | 9·631180 | 19 111 | 10·368820 | 10·036485 | 19 17 | 9·963515 | 22 | 30 |
| 10 | 40 | 9·594842 | 20 99 | 10·405158 | 9·631355 | 20 117 | 10·368645 | 10·036512 | 20 18 | 9·963488 | 20 | 50 |
| 30 | 42 | 9·594990 | 21 104 | 10·405010 | 9·631529 | 21 122 | 10·368471 | 10·036539 | 21 19 | 9·963461 | 18 | 30 |
| 11 | 44 | 9·595137 | 22 109 | 10·404863 | 9·631704 | 22 128 | 10·368296 | 10·036566 | 22 20 | 9·963434 | 16 | 49 |
| 30 | 46 | 9·595285 | 23 114 | 10·404715 | 9·631878 | 23 134 | 10·368122 | 10·036593 | 23 21 | 9·963407 | 14 | 30 |
| 12 | 48 | 9·595432 | 24 118 | 10·404568 | 9·632053 | 24 140 | 10·367947 | 10·036621 | 24 22 | 9·963379 | 12 | 48 |
| 30 | 50 | 9·595580 | 25 123 | 10·404420 | 9·632227 | 25 146 | 10·367773 | 10·036648 | 25 22 | 9·963352 | 10 | 30 |
| 13 | 52 | 9·595727 | 26 128 | 10·404273 | 9·632402 | 26 152 | 10·367598 | 10·036675 | 26 23 | 9·963325 | 8 | 47 |
| 30 | 54 | 9·595874 | 27 133 | 10·404126 | 9·632576 | 27 157 | 10·367424 | 10·036702 | 27 24 | 9·963298 | 6 | 30 |
| 14 | 56 | 9·596021 | 28 138 | 10·403979 | 9·632750 | 28 163 | 10·367250 | 10·036729 | 28 25 | 9·963271 | 4 | 46 |
| 30 | 58 | 9·596168 | 29 143 | 10·403832 | 9·632924 | 29 169 | 10·367076 | 10·036756 | 29 26 | 9·963244 | 2 | 30 |
| 15 | **33** | 9·596315 | 30 148 | 10·403685 | 9·633099 | 30 175 | 10·366901 | 10·036783 | 30 27 | 9·963217 | **27** | 45 |
| 30 | 2 | 9·596462 | 1 5 | 10·403538 | 9·633273 | 1 6 | 10·366727 | 10·036810 | 1 1 | 9·963190 | 58 | 30 |
| 16 | 4 | 9·596609 | 2 10 | 10·403391 | 9·633447 | 2 12 | 10·366553 | 10·036837 | 2 2 | 9·963163 | 56 | 44 |
| 30 | 6 | 9·596756 | 3 15 | 10·403244 | 9·633621 | 3 17 | 10·366379 | 10·036865 | 3 3 | 9·963135 | 54 | 30 |
| 17 | 8 | 9·596903 | 4 20 | 10·403097 | 9·633795 | 4 23 | 10·366205 | 10·036892 | 4 4 | 9·963108 | 52 | 43 |
| 30 | 10 | 9·597050 | 5 24 | 10·402950 | 9·633969 | 5 29 | 10·366031 | 10·036919 | 5 5 | 9·963081 | 50 | 30 |
| 18 | 12 | 9·597196 | 6 29 | 10·402804 | 9·634143 | 6 35 | 10·365857 | 10·036946 | 6 5 | 9·963054 | 48 | 42 |
| 30 | 14 | 9·597343 | 7 34 | 10·402657 | 9·634316 | 7 40 | 10·365684 | 10·036973 | 7 6 | 9·963027 | 46 | 30 |
| 19 | 16 | 9·597490 | 8 39 | 10·402510 | 9·634490 | 8 46 | 10·365510 | 10·037001 | 8 7 | 9·962999 | 44 | 41 |
| 30 | 18 | 9·597636 | 9 44 | 10·402364 | 9·634664 | 9 52 | 10·365336 | 10·037028 | 9 8 | 9·962972 | 42 | 30 |
| 20 | 20 | 9·597783 | 10 49 | 10·402217 | 9·634838 | 10 58 | 10·365162 | 10·037055 | 10 9 | 9·962945 | 40 | 40 |
| 30 | 22 | 9·597929 | 11 54 | 10·402071 | 9·635011 | 11 64 | 10·364989 | 10·037082 | 11 10 | 9·962918 | 38 | 30 |
| 21 | 24 | 9·598075 | 12 58 | 10·401925 | 9·635185 | 12 69 | 10·364815 | 10·037110 | 12 11 | 9·962890 | 36 | 39 |
| 30 | 26 | 9·598222 | 13 63 | 10·401778 | 9·635359 | 13 75 | 10·364641 | 10·037137 | 13 12 | 9·962863 | 34 | 30 |
| 22 | 28 | 9·598368 | 14 68 | 10·401632 | 9·635532 | 14 81 | 10·364468 | 10·037164 | 14 13 | 9·962836 | 32 | 38 |
| 30 | 30 | 9·598514 | 15 73 | 10·401486 | 9·635706 | 15 87 | 10·364294 | 10·037191 | 15 14 | 9·962809 | 30 | 30 |
| 23 | 32 | 9·598660 | 16 78 | 10·401340 | 9·635879 | 16 92 | 10·364121 | 10·037219 | 16 15 | 9·962781 | 28 | 37 |
| 30 | 34 | 9·598806 | 17 83 | 10·401194 | 9·636052 | 17 98 | 10·363948 | 10·037246 | 17 15 | 9·962754 | 26 | 30 |
| 24 | 36 | 9·598952 | 18 88 | 10·401048 | 9·636226 | 18 104 | 10·363774 | 10·037273 | 18 16 | 9·962727 | 24 | 36 |
| 30 | 38 | 9·599098 | 19 93 | 10·400902 | 9·636399 | 19 110 | 10·363601 | 10·037301 | 19 17 | 9·962699 | 22 | 30 |
| 25 | 40 | 9·599244 | 20 98 | 10·400756 | 9·636572 | 20 116 | 10·363428 | 10·037328 | 20 18 | 9·962672 | 20 | 35 |
| 30 | 42 | 9·599390 | 21 102 | 10·400610 | 9·636745 | 21 121 | 10·363255 | 10·037355 | 21 19 | 9·962645 | 18 | 30 |
| 26 | 44 | 9·599536 | 22 107 | 10·400464 | 9·636919 | 22 127 | 10·363081 | 10·037383 | 22 20 | 9·962617 | 16 | 34 |
| 30 | 46 | 9·599681 | 23 112 | 10·400319 | 9·637092 | 23 133 | 10·362908 | 10·037410 | 23 21 | 9·962590 | 14 | 30 |
| 27 | 48 | 9·599827 | 24 117 | 10·400173 | 9·637265 | 24 139 | 10·362735 | 10·037438 | 24 22 | 9·962562 | 12 | 33 |
| 30 | 50 | 9·599973 | 25 122 | 10·400027 | 9·637438 | 25 144 | 10·362562 | 10·037465 | 25 23 | 9·962535 | 10 | 30 |
| 28 | 52 | 9·600118 | 26 127 | 10·399882 | 9·637611 | 26 150 | 10·362389 | 10·037492 | 26 24 | 9·962508 | 8 | 32 |
| 30 | 54 | 9·600264 | 27 131 | 10·399736 | 9·637783 | 27 156 | 10·362217 | 10·037520 | 27 25 | 9·962480 | 6 | 30 |
| 29 | 56 | 9·600409 | 28 136 | 10·399591 | 9·637956 | 28 162 | 10·362044 | 10·037547 | 28 25 | 9·962453 | 4 | 31 |
| 30 | 58 | 9·600554 | 29 141 | 10·399446 | 9·638129 | 29 168 | 10·361871 | 10·037575 | 29 26 | 9·962425 | 2 | 30 |
| 30 | **34** | 9·600700 | 30 146 | 10·399300 | 9·638302 | 30 173 | 10·361698 | 10·037602 | 30 27 | 9·962398 | 0 | 30 |
| ′ ″ | m. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |
| | | | | | | 66° | | | | | 4ʰ 26ᵐ | |

TABLE XXVI.—(*continued*).

## LOG. SINES, COSINES, &c.

$1^h\ 34^m$ — 23°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·600700 | | 10·399300 | 9·638302 | | 10·361698 | 10·037602 | | 9·962398 | 26 | 30 |
| 30 | 2 | 9·600845 | 1″ 5 | 10·399155 | 9·638475 | 1″ 6 | 10·361525 | 10·037630 | 1″ 1 | 9·962370 | 58 | 30 |
| 31 | 4 | 9·600990 | 2 10 | 10·399010 | 9·638647 | 2 11 | 10·361353 | 10·037657 | 2 2 | 9·962343 | 56 | 29 |
| 30 | 6 | 9·601135 | 3 14 | 10·398865 | 9·638820 | 3 17 | 10·361180 | 10·037685 | 3 3 | 9·962315 | 54 | 30 |
| 32 | 8 | 9·601280 | 4 19 | 10·398720 | 9·638992 | 4 23 | 10·361008 | 10·037712 | 4 4 | 9·962288 | 52 | 28 |
| 30 | 10 | 9·601425 | 5 24 | 10·398575 | 9·639165 | 5 29 | 10·360835 | 10·037740 | 5 5 | 9·962260 | 50 | 30 |
| 33 | 12 | 9·601570 | 6 29 | 10·398430 | 9·639337 | 6 34 | 10·360663 | 10·037767 | 6 6 | 9·962233 | 48 | 27 |
| 30 | 14 | 9·601715 | 7 34 | 10·398285 | 9·639510 | 7 40 | 10·360490 | 10·037795 | 7 6 | 9·962205 | 46 | 30 |
| 34 | 16 | 9·601860 | 8 38 | 10·398140 | 9·639682 | 8 46 | 10·360318 | 10·037822 | 8 7 | 9·962178 | 44 | 26 |
| 30 | 18 | 9·602005 | 9 43 | 10·397995 | 9·639855 | 9 52 | 10·360145 | 10·037850 | 9 8 | 9·962150 | 42 | 30 |
| 35 | 20 | 9·602150 | 10 48 | 10·397850 | 9·640027 | 10 57 | 10·359973 | 10·037877 | 10 9 | 9·962123 | 40 | 25 |
| 30 | 22 | 9·602294 | 11 53 | 10·397706 | 9·640199 | 11 63 | 10·359801 | 10·037905 | 11 10 | 9·962095 | 38 | 30 |
| 36 | 24 | 9·602439 | 12 58 | 10·397561 | 9·640371 | 12 69 | 10·359629 | 10·037933 | 12 11 | 9·962067 | 36 | 24 |
| 30 | 26 | 9·602583 | 13 62 | 10·397417 | 9·640544 | 13 74 | 10·359456 | 10·037960 | 13 12 | 9·962040 | 34 | 30 |
| 37 | 28 | 9·602728 | 14 67 | 10·397272 | 9·640716 | 14 80 | 10·359284 | 10·037988 | 14 13 | 9·962012 | 32 | 23 |
| 30 | 30 | 9·602872 | 15 72 | 10·397128 | 9·640888 | 15 86 | 10·359112 | 10·038015 | 15 14 | 9·961985 | 30 | 30 |
| 38 | 32 | 9·603017 | 16 77 | 10·396983 | 9·641060 | 16 92 | 10·358940 | 10·038043 | 16 15 | 9·961957 | 28 | 22 |
| 30 | 34 | 9·603161 | 17 82 | 10·396839 | 9·641232 | 17 97 | 10·358768 | 10·038071 | 17 16 | 9·961929 | 26 | 30 |
| 39 | 36 | 9·603305 | 18 87 | 10·396695 | 9·641404 | 18 103 | 10·358596 | 10·038098 | 18 17 | 9·961902 | 24 | 21 |
| 30 | 38 | 9·603449 | 19 92 | 10·396551 | 9·641575 | 19 109 | 10·358425 | 10·038126 | 19 17 | 9·961874 | 22 | 30 |
| 40 | 40 | 9·603594 | 20 96 | 10·396406 | 9·641747 | 20 115 | 10·358253 | 10·038154 | 20 18 | 9·961846 | 20 | 20 |
| 30 | 42 | 9·603738 | 21 101 | 10·396262 | 9·641919 | 21 120 | 10·358081 | 10·038181 | 21 19 | 9·961819 | 18 | 30 |
| 41 | 44 | 9·603882 | 22 106 | 10·396118 | 9·642091 | 22 126 | 10·357909 | 10·038209 | 22 20 | 9·961791 | 16 | 19 |
| 30 | 46 | 9·604026 | 23 111 | 10·395974 | 9·642263 | 23 132 | 10·357737 | 10·038237 | 23 21 | 9·961763 | 14 | 30 |
| 42 | 48 | 9·604170 | 24 115 | 10·395830 | 9·642434 | 24 138 | 10·357566 | 10·038265 | 24 22 | 9·961735 | 12 | 18 |
| 30 | 50 | 9·604313 | 25 120 | 10·395687 | 9·642606 | 25 143 | 10·357394 | 10·038292 | 25 23 | 9·961708 | 10 | 30 |
| 43 | 52 | 9·604457 | 26 125 | 10·395543 | 9·642777 | 26 149 | 10·357223 | 10·038320 | 26 24 | 9·961680 | 8 | 17 |
| 30 | 54 | 9·604601 | 27 130 | 10·395399 | 9·642949 | 27 155 | 10·357051 | 10·038348 | 27 25 | 9·961652 | 6 | 30 |
| 44 | 56 | 9·604745 | 28 134 | 10·395255 | 9·643120 | 28 160 | 10·356880 | 10·038376 | 28 26 | 9·961624 | 4 | 16 |
| 30 | 58 | 9·604888 | 29 139 | 10·395112 | 9·643292 | 29 166 | 10·356708 | 10·038403 | 29 27 | 9·961597 | 2 | 30 |
| 45 | **35** | 9·605032 | 30 144 | 10·394968 | 9·643463 | 30 172 | 10·356537 | 10·038431 | 30 28 | 9·961569 | **25** | 15 |
| 30 | 2 | 9·605176 | 1 5 | 10·394824 | 9·643634 | 1 6 | 10·356366 | 10·038459 | 1 1 | 9·961541 | 58 | 30 |
| 46 | 4 | 9·605319 | 2 10 | 10·394681 | 9·643806 | 2 11 | 10·356194 | 10·038487 | 2 2 | 9·961513 | 56 | 14 |
| 30 | 6 | 9·605462 | 3 14 | 10·394538 | 9·643977 | 3 17 | 10·356023 | 10·038515 | 3 3 | 9·961485 | 54 | 30 |
| 47 | 8 | 9·605606 | 4 19 | 10·394394 | 9·644148 | 4 23 | 10·355852 | 10·038542 | 4 4 | 9·961458 | 52 | 13 |
| 30 | 10 | 9·605749 | 5 24 | 10·394251 | 9·644319 | 5 28 | 10·355681 | 10·038570 | 5 5 | 9·961430 | 50 | 30 |
| 48 | 12 | 9·605892 | 6 29 | 10·394108 | 9·644490 | 6 34 | 10·355510 | 10·038598 | 6 6 | 9·961402 | 48 | 12 |
| 30 | 14 | 9·606035 | 7 33 | 10·393965 | 9·644661 | 7 40 | 10·355339 | 10·038626 | 7 7 | 9·961374 | 46 | 30 |
| 49 | 16 | 9·606179 | 8 38 | 10·393821 | 9·644832 | 8 46 | 10·355168 | 10·038654 | 8 7 | 9·961346 | 44 | 11 |
| 30 | 18 | 9·606322 | 9 43 | 10·393678 | 9·645003 | 9 51 | 10·354997 | 10·038682 | 9 8 | 9·961318 | 42 | 30 |
| 50 | 20 | 9·606465 | 10 48 | 10·393535 | 9·645174 | 10 57 | 10·354826 | 10·038710 | 10 9 | 9·961290 | 40 | 10 |
| 30 | 22 | 9·606608 | 11 52 | 10·393392 | 9·645345 | 11 63 | 10·354655 | 10·038737 | 11 10 | 9·961263 | 38 | 30 |
| 51 | 24 | 9·606751 | 12 57 | 10·393249 | 9·645516 | 12 68 | 10·354484 | 10·038765 | 12 11 | 9·961235 | 36 | 9 |
| 30 | 26 | 9·606893 | 13 62 | 10·393107 | 9·645687 | 13 74 | 10·354313 | 10·038793 | 13 12 | 9·961207 | 34 | 30 |
| 52 | 28 | 9·607036 | 14 67 | 10·392964 | 9·645857 | 14 80 | 10·354143 | 10·038821 | 14 13 | 9·961179 | 32 | 8 |
| 30 | 30 | 9·607179 | 15 71 | 10·392821 | 9·646028 | 15 85 | 10·353972 | 10·038849 | 15 14 | 9·961151 | 30 | 30 |
| 53 | 32 | 9·607322 | 16 76 | 10·392678 | 9·646199 | 16 91 | 10·353801 | 10·038877 | 16 15 | 9·961123 | 28 | 7 |
| 30 | 34 | 9·607464 | 17 81 | 10·392536 | 9·646369 | 17 97 | 10·353631 | 10·038905 | 17 16 | 9·961095 | 26 | 30 |
| 54 | 36 | 9·607607 | 18 86 | 10·392393 | 9·646540 | 18 102 | 10·353460 | 10·038933 | 18 17 | 9·961067 | 24 | 6 |
| 30 | 38 | 9·607749 | 19 90 | 10·392251 | 9·646710 | 19 108 | 10·353290 | 10·038961 | 19 18 | 9·961039 | 22 | 30 |
| 55 | 40 | 9·607892 | 20 95 | 10·392108 | 9·646881 | 20 114 | 10·353119 | 10·038989 | 20 19 | 9·961011 | 20 | 5 |
| 30 | 42 | 9·608034 | 21 100 | 10·391966 | 9·647051 | 21 119 | 10·352949 | 10·039017 | 21 20 | 9·960983 | 18 | 30 |
| 56 | 44 | 9·608177 | 22 105 | 10·391823 | 9·647222 | 22 125 | 10·352778 | 10·039045 | 22 20 | 9·960955 | 16 | 4 |
| 30 | 46 | 9·608319 | 23 110 | 10·391681 | 9·647392 | 23 131 | 10·352608 | 10·039073 | 23 21 | 9·960927 | 14 | 30 |
| 57 | 48 | 9·608461 | 24 114 | 10·391539 | 9·647562 | 24 137 | 10·352438 | 10·039101 | 24 22 | 9·960899 | 12 | 3 |
| 30 | 50 | 9·608603 | 25 119 | 10·391397 | 9·647733 | 25 142 | 10·352267 | 10·039129 | 25 23 | 9·960871 | 10 | 30 |
| 58 | 52 | 9·608745 | 26 124 | 10·391255 | 9·647903 | 26 148 | 10·352097 | 10·039157 | 26 24 | 9·960843 | 8 | 2 |
| 30 | 54 | 9·608887 | 27 128 | 10·391113 | 9·648073 | 27 154 | 10·351927 | 10·039186 | 27 25 | 9·960814 | 6 | 30 |
| 59 | 56 | 9·609029 | 28 133 | 10·390971 | 9·648243 | 28 159 | 10·351757 | 10·039214 | 28 26 | 9·960786 | 4 | 1 |
| 30 | 58 | 9·609171 | 29 138 | 10·390829 | 9·648413 | 29 165 | 10·351587 | 10·039242 | 29 27 | 9·960758 | 2 | 30 |
| 60 | **36** | 9·609313 | 30 143 | 10·390687 | 9·648583 | 30 171 | 10·351417 | 10·039270 | 30 28 | 9·960730 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

66° — $4^h\ 24^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES. &c.

1h 36m — 24°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·609313 | | 10·390687 | 9·648583 | | 10·351417 | 10·039270 | | 9·960730 | 24 | 60 |
| 30 | 2 | 9·609455 | 1″ 5 | 10·390545 | 9·648753 | 1″ 6 | 10·351247 | 10·039298 | 1″ 1 | 9·960702 | 58 | 30 |
| 1 | 4 | 9·609597 | 2 9 | 10·390403 | 9·648923 | 2 11 | 10·351077 | 10·039326 | 2 2 | 9·960674 | 56 | 59 |
| 30 | 6 | 9·609739 | 3 14 | 10·390261 | 9·649093 | 3 17 | 10·350907 | 10·039354 | 3 3 | 9·960646 | 54 | 30 |
| 2 | 8 | 9·609880 | 4 19 | 10·390120 | 9·649263 | 4 23 | 10·350737 | 10·039382 | 4 4 | 9·960618 | 52 | 58 |
| 30 | 10 | 9·610022 | 5 23 | 10·389978 | 9·649433 | 5 28 | 10·350567 | 10·039411 | 5 5 | 9·960589 | 50 | 30 |
| 3 | 12 | 9·610164 | 6 28 | 10·389836 | 9·649602 | 6 34 | 10·350398 | 10·039439 | 6 6 | 9·960561 | 48 | 57 |
| 30 | 14 | 9·610305 | 7 33 | 10·389695 | 9·649772 | 7 39 | 10·350228 | 10·039467 | 7 7 | 9·960533 | 46 | 30 |
| 4 | 16 | 9·610447 | 8 38 | 10·389553 | 9·649942 | 8 45 | 10·350058 | 10·039495 | 8 8 | 9·960505 | 44 | 56 |
| 30 | 18 | 9·610588 | 9 42 | 10·389412 | 9·650111 | 9 51 | 10·349889 | 10·039523 | 9 8 | 9·960477 | 42 | 30 |
| 5 | 20 | 9·610729 | 10 47 | 10·389271 | 9·650281 | 10 56 | 10·349719 | 10·039552 | 10 9 | 9·960448 | 40 | 55 |
| 30 | 22 | 9·610871 | 11 52 | 10·389129 | 9·650450 | 11 62 | 10·349550 | 10·039580 | 11 10 | 9·960420 | 38 | 30 |
| 6 | 24 | 9·611012 | 12 56 | 10·388988 | 9·650620 | 12 68 | 10·349380 | 10·039608 | 12 11 | 9·960392 | 36 | 54 |
| 30 | 26 | 9·611153 | 13 61 | 10·388847 | 9·650789 | 13 73 | 10·349211 | 10·039636 | 13 12 | 9·960364 | 34 | 30 |
| 7 | 28 | 9·611294 | 14 66 | 10·388706 | 9·650959 | 14 79 | 10·349041 | 10·039665 | 14 13 | 9·960335 | 32 | 53 |
| 30 | 30 | 9·611435 | 15 71 | 10·388565 | 9·651128 | 15 85 | 10·348872 | 10·039693 | 15 14 | 9·960307 | 30 | 30 |
| 8 | 32 | 9·611576 | 16 75 | 10·388424 | 9·651297 | 16 90 | 10·348703 | 10·039721 | 16 15 | 9·960279 | 28 | 52 |
| 30 | 34 | 9·611717 | 17 80 | 10·388283 | 9·651467 | 17 96 | 10·348533 | 10·039750 | 17 16 | 9·960250 | 26 | 30 |
| 9 | 36 | 9·611858 | 18 85 | 10·388142 | 9·651636 | 18 102 | 10·348364 | 10·039778 | 18 17 | 9·960222 | 24 | 51 |
| 30 | 38 | 9·611999 | 19 89 | 10·388001 | 9·651805 | 19 107 | 10·348195 | 10·039806 | 19 18 | 9·960194 | 22 | 30 |
| 10 | 40 | 9·612140 | 20 94 | 10·387860 | 9·651974 | 20 113 | 10·348026 | 10·039835 | 20 19 | 9·960165 | 20 | 50 |
| 30 | 42 | 9·612280 | 21 99 | 10·387720 | 9·652143 | 21 118 | 10·347857 | 10·039863 | 21 20 | 9·960137 | 18 | 30 |
| 11 | 44 | 9·6124[illegible]1 | 22 103 | 10·387579 | 9·652312 | 22 124 | 10·347688 | 10·039891 | 22 21 | 9·960109 | 16 | 49 |
| 30 | 46 | 9·612[illegible]2 | 23 108 | 10·387438 | 9·652481 | 23 130 | 10·347519 | 10·039920 | 23 22 | 9·960080 | 14 | 30 |
| 12 | 48 | 9·612702 | 24 113 | 10·387298 | 9·652650 | 24 135 | 10·34735[illegible] | 10·039948 | 24 23 | 9·960052 | 12 | 48 |
| 30 | 50 | 9·612843 | 25 117 | 10·387157 | 9·652819 | 25 141 | 10·347181 | 10·039976 | 25 23 | 9·960024 | 10 | 30 |
| 13 | 52 | 9·612983 | 26 122 | 10·387017 | 9·652988 | 26 147 | 10·347012 | 10·040005 | 26 24 | 9·959995 | 8 | 47 |
| 30 | 54 | 9·613124 | 27 127 | 10·386876 | 9·653157 | 27 152 | 10·346843 | 10·040033 | 27 25 | 9·959967 | 6 | 30 |
| 14 | 56 | 9·613264 | 28 132 | 10·386736 | 9·653326 | 28 158 | 10·346674 | 10·040062 | 28 26 | 9·959938 | 4 | 46 |
| 30 | 58 | 9·613404 | 29 136 | 10·386596 | 9·653494 | 29 164 | 10·346506 | 10·040090 | 29 27 | 9·959910 | 2 | 30 |
| 15 | **37** | 9·613545 | 30 141 | 10·386455 | 9·653663 | 30 169 | 10·346337 | 10·040118 | 30 28 | 9·959882 | **23** | 45 |
| 30 | 2 | 9·613685 | 1 5 | 10·386315 | 9·653832 | 1 6 | 10·346168 | 10·040147 | 1 1 | 9·959853 | 58 | 30 |
| 16 | 4 | 9·613825 | 2 9 | 10·386175 | 9·654000 | 2 11 | 10·346000 | 10·040175 | 2 2 | 9·959825 | 56 | 44 |
| 30 | 6 | 9·613965 | 3 14 | 10·386035 | 9·654169 | 3 17 | 10·345831 | 10·040204 | 3 3 | 9·959796 | 54 | 30 |
| 17 | 8 | 9·614105 | 4 19 | 10·385895 | 9·654337 | 4 22 | 10·345663 | 10·040232 | 4 4 | 9·959768 | 52 | 43 |
| 30 | 10 | 9·614245 | 5 23 | 10·385755 | 9·654506 | 5 28 | 10·345494 | 10·040261 | 5 5 | 9·959739 | 50 | 30 |
| 18 | 12 | 9·614385 | 6 28 | 10·385615 | 9·654674 | 6 34 | 10·345326 | 10·040289 | 6 6 | 9·959711 | 48 | 42 |
| 30 | 14 | 9·614525 | 7 32 | 10·385475 | 9·654843 | 7 39 | 10·345157 | 10·040318 | 7 7 | 9·959682 | 46 | 30 |
| 19 | 16 | 9·614665 | 8 37 | 10·385335 | 9·655011 | 8 45 | 10 344989 | 10·040346 | 8 8 | 9·959654 | 44 | 41 |
| 30 | 18 | 9·614804 | 9 42 | 10·385196 | 9·655179 | 9 50 | 10·344821 | 10·040375 | 9 9 | 9·959625 | 42 | 30 |
| 20 | 20 | 9·614944 | 10 46 | 10·385056 | 9·655348 | 10 56 | 10·344652 | 10·040404 | 10 10 | 9·959596 | 40 | 40 |
| 30 | 22 | 9·615084 | 11 51 | 10·384916 | 9·655516 | 11 62 | 10·344484 | 10·040432 | 11 10 | 9·959568 | 38 | 30 |
| 21 | 24 | 9·615223 | 12 56 | 10·384777 | 9·655684 | 12 67 | 10·344316 | 10·040461 | 12 11 | 9·959539 | 36 | 39 |
| 30 | 26 | 9·615363 | 13 61 | 10·384637 | 9·655852 | 13 73 | 10·344148 | 10·040489 | 13 12 | 9·959511 | 34 | 30 |
| 22 | 28 | 9·615502 | 14 65 | 10·384498 | 9·656020 | 14 78 | 10·343980 | 10·040518 | 14 13 | 9·959482 | 32 | 38 |
| 30 | 30 | 9·615642 | 15 70 | 10·384358 | 9·656188 | 15 84 | 10·343812 | 10·040547 | 15 14 | 9·959453 | 30 | 30 |
| 23 | 32 | 9·615781 | 16 75 | 10·384219 | 9·656356 | 16 90 | 10·343644 | 10·040575 | 16 15 | 9·959425 | 28 | 37 |
| 30 | 34 | 9·615921 | 17 79 | 10·384079 | 9·656524 | 17 95 | 10·343476 | 10·040604 | 17 16 | 9·959396 | 26 | 30 |
| 24 | 36 | 9·616060 | 18 84 | 10·383940 | 9·656692 | 18 101 | 10·343308 | 10·040632 | 18 17 | 9·959368 | 24 | 36 |
| 30 | 38 | 9·616199 | 19 89 | 10·383801 | 9·656860 | 19 106 | 10·343140 | 10·040661 | 19 18 | 9·959339 | 22 | 30 |
| 25 | 40 | 9·616338 | 20 93 | 10·383662 | 9·657028 | 20 112 | 10·342972 | 10·040690 | 20 19 | 9·959310 | 20 | 35 |
| 30 | 42 | 9·616477 | 21 98 | 10·383523 | 9·657196 | 21 118 | 10·342804 | 10·040718 | 21 20 | 9·959282 | 18 | 30 |
| 26 | 44 | 9·616616 | 22 103 | 10·383384 | 9·657364 | 22 123 | 10·342636 | 10·040747 | 22 21 | 9·959253 | 16 | 34 |
| 30 | 46 | 9·616755 | 23 107 | 10·383245 | 9·657531 | 23 129 | 10·342469 | 10·040776 | 23 22 | 9·959224 | 14 | 30 |
| 27 | 48 | 9·616894 | 24 112 | 10·383106 | 9·657699 | 24 134 | 10·342301 | 10·040805 | 24 23 | 9·959195 | 12 | 33 |
| 30 | 50 | 9·617033 | 25 117 | 10·382967 | 9·657867 | 25 140 | 10·342133 | 10·040833 | 25 24 | 9·959167 | 10 | 30 |
| 28 | 52 | 9·617172 | 26 122 | 10·382828 | 9·658034 | 26 146 | 10·341966 | 10·040862 | 26 25 | 9·959138 | 8 | 32 |
| 30 | 54 | 9·617311 | 27 126 | 10·382689 | 9·658202 | 27 151 | 10·341798 | 10·040891 | 27 26 | 9·959109 | 6 | 30 |
| 29 | 56 | 9·617450 | 28 131 | 10·382550 | 9·658369 | 28 157 | 10·341631 | 10·040920 | 28 27 | 9·959080 | 4 | 31 |
| 30 | 58 | 9·617588 | 29 135 | 10·382412 | 9·658537 | 29 162 | 10·341463 | 10·040948 | 29 28 | 9·959052 | 2 | 30 |
| 30 | **38** | 9·617727 | 30 140 | 10·382273 | 9·658704 | 30 168 | 10·341296 | 10·040977 | 30 29 | 9·959023 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

65° — 4h 22m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

1h 38m — 24°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·617727 | | 10·382273 | 9·658704 | | 10·341296 | 10·040977 | | 9·959023 | 22 | 30 |
| 30 | 2 | 9·617866 | 1″ 5 | 10·382134 | 9·658871 | 1″ 6 | 10·341129 | 10·041006 | 1″ 1 | 9·958994 | 58 | 30 |
| 31 | 4 | 9·618004 | 2 9 | 10·381996 | 9·659039 | 2 11 | 10·340961 | 10·041035 | 2 2 | 9·958965 | 56 | 29 |
| 30 | 6 | 9·618143 | 3 14 | 10·381857 | 9·659206 | 3 17 | 10·340794 | 10·041063 | 3 3 | 9·958937 | 54 | 30 |
| 32 | 8 | 9·618281 | 4 18 | 10·381719 | 9·659373 | 4 22 | 10·340627 | 10·041092 | 4 4 | 9·958908 | 52 | 28 |
| 30 | 10 | 9·618419 | 5 23 | 10·381581 | 9·659540 | 5 28 | 10·340460 | 10·041121 | 5 5 | 9·958879 | 50 | 30 |
| 33 | 12 | 9·618558 | 6 28 | 10·381442 | 9·659708 | 6 33 | 10·340292 | 10·041150 | 6 6 | 9·958850 | 48 | 27 |
| 30 | 14 | 9·618696 | 7 32 | 10·381304 | 9·659875 | 7 39 | 10·340125 | 10·041179 | 7 7 | 9·958821 | 46 | 30 |
| 34 | 16 | 9·618834 | 8 37 | 10·381166 | 9·660042 | 8 44 | 10·339958 | 10·041208 | 8 8 | 9·958792 | 44 | 26 |
| 30 | 18 | 9·618972 | 9 41 | 10·381028 | 9·660209 | 9 50 | 10·339791 | 10·041237 | 9 9 | 9·958763 | 42 | 30 |
| 35 | 20 | 9·619110 | 10 46 | 10·380890 | 9·660376 | 10 56 | 10·339624 | 10·041266 | 10 10 | 9·958734 | 40 | 25 |
| 30 | 22 | 9·619248 | 11 50 | 10·380752 | 9·660543 | 11 61 | 10·339457 | 10·041294 | 11 11 | 9·958706 | 38 | 30 |
| 36 | 24 | 9·619386 | 12 55 | 10·380614 | 9·660710 | 12 67 | 10·339290 | 10·041323 | 12 12 | 9·958677 | 36 | 24 |
| 30 | 26 | 9·619524 | 13 59 | 10·380476 | 9·660877 | 13 72 | 10·339123 | 10·041352 | 13 12 | 9·958648 | 34 | 30 |
| 37 | 28 | 9·619662 | 14 64 | 10·380338 | 9·661043 | 14 78 | 10·338957 | 10·041381 | 14 13 | 9·958619 | 32 | 23 |
| 30 | 30 | 9·619800 | 15 69 | 10·380200 | 9·661210 | 15 83 | 10·338790 | 10·041410 | 15 14 | 9·958590 | 30 | 30 |
| 38 | 32 | 9·619938 | 16 73 | 10·380062 | 9·661377 | 16 89 | 10·338623 | 10·041439 | 16 15 | 9·958561 | 28 | 22 |
| 30 | 34 | 9·620076 | 17 78 | 10·379924 | 9·661544 | 17 95 | 10·338456 | 10·041468 | 17 16 | 9·958532 | 26 | 30 |
| 39 | 36 | 9·620213 | 18 83 | 10·379787 | 9·661710 | 18 100 | 10·338290 | 10·041497 | 18 17 | 9·958503 | 24 | 21 |
| 30 | 38 | 9·620351 | 19 87 | 10·379649 | 9·661877 | 19 106 | 10·338123 | 10·041526 | 19 18 | 9·958474 | 22 | 30 |
| 40 | 40 | 9·620488 | 20 92 | 10·379512 | 9·662043 | 20 111 | 10·337957 | 10·041555 | 20 19 | 9·958445 | 20 | 20 |
| 30 | 42 | 9·620626 | 21 96 | 10·379374 | 9·662210 | 21 117 | 10·337790 | 10·041584 | 21 20 | 9·958416 | 18 | 30 |
| 41 | 44 | 9·620763 | 22 101 | 10·379237 | 9·662376 | 22 122 | 10·337624 | 10·041613 | 22 21 | 9·958387 | 16 | 19 |
| 30 | 46 | 9·620901 | 23 105 | 10·379099 | 9·662543 | 23 128 | 10·337457 | 10·041642 | 23 22 | 9·958358 | 14 | 30 |
| 42 | 48 | 9·621038 | 24 110 | 10·378962 | 9·662709 | 24 133 | 10·337291 | 10·041671 | 24 23 | 9·958329 | 12 | 18 |
| 30 | 50 | 9·621175 | 25 114 | 10·378825 | 9·662876 | 25 139 | 10·337124 | 10·041700 | 25 24 | 9·958300 | 10 | 30 |
| 43 | 52 | 9·621313 | 26 119 | 10·378687 | 9·663042 | 26 145 | 10·336958 | 10·041729 | 26 25 | 9·958271 | 8 | 17 |
| 30 | 54 | 9·621450 | 27 124 | 10·378550 | 9·663208 | 27 150 | 10·336792 | 10·041758 | 27 26 | 9·958242 | 6 | 30 |
| 44 | 56 | 9·621587 | 28 129 | 10·378413 | 9·663375 | 28 156 | 10·336625 | 10·041787 | 28 27 | 9·958213 | 4 | 16 |
| 30 | 58 | 9·621724 | 29 133 | 10·378276 | 9·663541 | 29 161 | 10·336459 | 10·041817 | 29 28 | 9·958183 | 2 | 30 |
| 45 | 39 | 9·621861 | 30 138 | 10·378139 | 9·663707 | 30 167 | 10·336293 | 10·041846 | 30 29 | 9·958154 | 21 | 15 |
| 30 | 2 | 9·621998 | 1 5 | 10·378002 | 9·663873 | 1 6 | 10·336127 | 10·041875 | 1 1 | 9·958125 | 58 | 30 |
| 46 | 4 | 9·622135 | 2 9 | 10·377865 | 9·664039 | 2 11 | 10·335961 | 10·041904 | 2 2 | 9·958096 | 56 | 14 |
| 30 | 6 | 9·622272 | 3 14 | 10·377728 | 9·664205 | 3 17 | 10·335795 | 10·041933 | 3 3 | 9·958067 | 54 | 30 |
| 47 | 8 | 9·622409 | 4 18 | 10·377591 | 9·664371 | 4 22 | 10·335629 | 10·041962 | 4 4 | 9·958038 | 52 | 13 |
| 30 | 10 | 9·622546 | 5 23 | 10·377454 | 9·664537 | 5 28 | 10·335463 | 10·041991 | 5 5 | 9·958009 | 50 | 30 |
| 48 | 12 | 9·622682 | 6 27 | 10·377318 | 9·664703 | 6 33 | 10·335297 | 10·042021 | 6 6 | 9·957979 | 48 | 12 |
| 30 | 14 | 9·622819 | 7 32 | 10·377181 | 9·664869 | 7 39 | 10·335131 | 10·042050 | 7 7 | 9·957950 | 46 | 30 |
| 49 | 16 | 9·622956 | 8 36 | 10·377044 | 9·665035 | 8 44 | 10·334965 | 10·042079 | 8 8 | 9·957921 | 44 | 11 |
| 30 | 18 | 9·623092 | 9 41 | 10·376908 | 9·665200 | 9 50 | 10·334800 | 10·042108 | 9 9 | 9·957892 | 42 | 30 |
| 50 | 20 | 9·623229 | 10 45 | 10·376771 | 9·665366 | 10 55 | 10·334634 | 10·042137 | 10 10 | 9·957863 | 40 | 10 |
| 30 | 22 | 9·623365 | 11 50 | 10·376635 | 9·665532 | 11 61 | 10·334468 | 10·042167 | 11 11 | 9·957833 | 38 | 30 |
| 51 | 24 | 9·623502 | 12 54 | 10·376498 | 9·665698 | 12 66 | 10·334302 | 10·042196 | 12 12 | 9·957804 | 36 | 9 |
| 30 | 26 | 9·623638 | 13 59 | 10·376362 | 9·665863 | 13 72 | 10·334137 | 10·042225 | 13 13 | 9·957775 | 34 | 30 |
| 52 | 28 | 9·623774 | 14 63 | 10·376226 | 9·666029 | 14 77 | 10·333971 | 10·042254 | 14 14 | 9·957746 | 32 | 8 |
| 30 | 30 | 9·623911 | 15 68 | 10·376089 | 9·666194 | 15 83 | 10·333806 | 10·042284 | 15 15 | 9·957716 | 30 | 30 |
| 53 | 32 | 9·624047 | 16 72 | 10·375953 | 9·666360 | 16 88 | 10·333640 | 10·042313 | 16 16 | 9·957687 | 28 | 7 |
| 30 | 34 | 9·624183 | 17 77 | 10·375817 | 9·666525 | 17 94 | 10·333475 | 10·042342 | 17 17 | 9·957658 | 26 | 30 |
| 54 | 36 | 9·624319 | 18 82 | 10·375681 | 9·666691 | 18 99 | 10·333309 | 10·042372 | 18 18 | 9·957628 | 24 | 6 |
| 30 | 38 | 9·624455 | 19 86 | 10·375545 | 9·666856 | 19 105 | 10·333144 | 10·042401 | 19 19 | 9·957599 | 22 | 30 |
| 55 | 40 | 9·624591 | 20 91 | 10·375409 | 9·667021 | 20 110 | 10·332979 | 10·042430 | 20 20 | 9·957570 | 20 | 5 |
| 30 | 42 | 9·624727 | 21 95 | 10·375273 | 9·667187 | 21 116 | 10·332813 | 10·042460 | 21 20 | 9·957540 | 18 | 30 |
| 56 | 44 | 9·624863 | 22 100 | 10·375137 | 9·667352 | 22 121 | 10·332648 | 10·042489 | 22 21 | 9·957511 | 16 | 4 |
| 30 | 46 | 9·624999 | 23 104 | 10·375001 | 9·667517 | 23 127 | 10·332483 | 10·042518 | 23 22 | 9·957482 | 14 | 30 |
| 57 | 48 | 9·625135 | 24 109 | 10·374865 | 9·667682 | 24 132 | 10·332318 | 10·042548 | 24 23 | 9·957452 | 12 | 3 |
| 30 | 50 | 9·625270 | 25 113 | 10·374730 | 9·667847 | 25 138 | 10·332153 | 10·042577 | 25 24 | 9·957423 | 10 | 30 |
| 58 | 52 | 9·625406 | 26 118 | 10·374594 | 9·668013 | 26 144 | 10·331987 | 10·042607 | 26 25 | 9·957393 | 8 | 2 |
| 30 | 54 | 9·625542 | 27 123 | 10·374458 | 9·668178 | 27 149 | 10·331822 | 10·042636 | 27 26 | 9·957364 | 6 | 30 |
| 59 | 56 | 9·625677 | 28 127 | 10·374323 | 9·668343 | 28 155 | 10·331657 | 10·042665 | 28 27 | 9·957335 | 4 | 1 |
| 30 | 58 | 9·625813 | 29 132 | 10·374187 | 9·668508 | 29 160 | 10·331492 | 10·042695 | 29 28 | 9·957305 | 2 | 30 |
| 60 | 40 | 9·625948 | 30 136 | 10·374052 | 9·668672 | 30 166 | 10·331327 | 10·042724 | 30 29 | 9·957276 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

65° — 4h 20m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

1h 40m — 25°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·625948 | | 10·374052 | 9·668673 | | 10·331327 | 10·042724 | | 9·957276 | **20** | 60 |
| 30 | 2 | 9·626084 | 1″ 4 | 10·373916 | 9·668837 | 1″ 5 | 10·331163 | 10·042754 | 1″ 1 | 9·957246 | 58 | 30 |
| 1 | 4 | 9·626219 | 2 9 | 10·373781 | 9·669002 | 2 11 | 10·330998 | 10·042783 | 2 2 | 9·957217 | 56 | 59 |
| 30 | 6 | 9·626354 | 3 13 | 10·373646 | 9·669167 | 3 16 | 10·330833 | 10·042813 | 3 3 | 9·957187 | 54 | 30 |
| 2 | 8 | 9·626490 | 4 18 | 10·373510 | 9·669332 | 4 22 | 10·330668 | 10·042842 | 4 4 | 9·957158 | 52 | 58 |
| 30 | 10 | 9·626625 | 5 22 | 10·373375 | 9·669497 | 5 27 | 10·330503 | 10·042872 | 5 5 | 9·957128 | 50 | 30 |
| 3 | 12 | 9·626760 | 6 27 | 10·373240 | 9·669661 | 6 33 | 10·330339 | 10·042901 | 6 6 | 9·957099 | 48 | 57 |
| 30 | 14 | 9·626895 | 7 31 | 10·373105 | 9·669826 | 7 38 | 10·330174 | 10·042931 | 7 7 | 9·957069 | 46 | 30 |
| 4 | 16 | 9·627030 | 8 36 | 10·372970 | 9·669991 | 8 44 | 10·330009 | 10·042960 | 8 8 | 9·957040 | 44 | 56 |
| 30 | 18 | 9·627165 | 9 40 | 10·372835 | 9·670155 | 9 49 | 10·329845 | 10·042990 | 9 9 | 9·957010 | 42 | 30 |
| 5 | 20 | 9·627300 | 10 45 | 10·372700 | 9·670320 | 10 55 | 10·329680 | 10·043019 | 10 10 | 9·956981 | 40 | 55 |
| 30 | 22 | 9·627435 | 11 49 | 10·372565 | 9·670484 | 11 60 | 10·329516 | 10·043049 | 11 11 | 9·956951 | 38 | 30 |
| 6 | 24 | 9·627570 | 12 54 | 10·372430 | 9·670649 | 12 66 | 10·329351 | 10·043079 | 12 12 | 9·956921 | 36 | 54 |
| 30 | 26 | 9·627705 | 13 58 | 10·372295 | 9·670813 | 13 71 | 10·329187 | 10·043108 | 13 13 | 9·956892 | 34 | 30 |
| 7 | 28 | 9·627840 | 14 63 | 10·372160 | 9·670977 | 14 77 | 10·329023 | 10·043138 | 14 14 | 9·956862 | 32 | 53 |
| 30 | 30 | 9·627974 | 15 67 | 10·372026 | 9·671142 | 15 82 | 10·328858 | 10·043167 | 15 15 | 9·956833 | 30 | 30 |
| 8 | 32 | 9·628109 | 16 72 | 10·371891 | 9·671306 | 16 88 | 10·328694 | 10·043197 | 16 16 | 9·956803 | 28 | 52 |
| 30 | 34 | 9·628244 | 17 76 | 10·371756 | 9·671470 | 17 93 | 10·328530 | 10·043227 | 17 17 | 9·956773 | 26 | 30 |
| 9 | 36 | 9·628378 | 18 81 | 10·371622 | 9·671635 | 18 99 | 10·328365 | 10·043256 | 18 18 | 9·956744 | 24 | 51 |
| 30 | 38 | 9·628513 | 19 85 | 10·371487 | 9·671799 | 19 104 | 10·328201 | 10·043286 | 19 19 | 9·956714 | 22 | 30 |
| 10 | 40 | 9·628647 | 20 90 | 10·371353 | 9·671963 | 20 110 | 10·328037 | 10·043316 | 20 20 | 9·956684 | 20 | 50 |
| 30 | 42 | 9·628782 | 21 94 | 10·371218 | 9·672127 | 21 115 | 10·327873 | 10·043345 | 21 21 | 9·956655 | 18 | 30 |
| 11 | 44 | 9·628916 | 22 99 | 10·371084 | 9·672291 | 22 121 | 10·327709 | 10·043375 | 22 22 | 9·956625 | 16 | 49 |
| 30 | 46 | 9·629050 | 23 103 | 10·370950 | 9·672455 | 23 126 | 10·327545 | 10·043405 | 23 23 | 9·956595 | 14 | 30 |
| 12 | 48 | 9·629185 | 24 108 | 10·370815 | 9·672619 | 24 132 | 10·327381 | 10·043434 | 24 24 | 9·956566 | 12 | 48 |
| 30 | 50 | 9·629319 | 25 112 | 10·370681 | 9·672783 | 25 137 | 10·327217 | 10·043464 | 25 25 | 9·956536 | 10 | 30 |
| 13 | 52 | 9·629453 | 26 117 | 10·370547 | 9·672947 | 26 142 | 10·327053 | 10·043494 | 26 26 | 9·956506 | 8 | 47 |
| 30 | 54 | 9·629587 | 27 121 | 10·370413 | 9·673111 | 27 148 | 10·326889 | 10·043524 | 27 27 | 9·956476 | 6 | 30 |
| 14 | 56 | 9·629721 | 28 126 | 10·370279 | 9·673274 | 28 153 | 10·326726 | 10·043553 | 28 28 | 9·956447 | 4 | 46 |
| 30 | 58 | 9·629855 | 29 130 | 10·370145 | 9·673438 | 29 159 | 10·326562 | 10·043583 | 29 29 | 9·956417 | 2 | 30 |
| 15 | **41** | 9·629989 | 30 135 | 10·370011 | 9·673602 | 30 164 | 10·326398 | 10·043613 | 30 30 | 9·956387 | **19** | 45 |
| 30 | 2 | 9·630123 | 1 4 | 10·369877 | 9·673766 | 1 5 | 10·326234 | 10·043643 | 1 1 | 9·956357 | 58 | 30 |
| 16 | 4 | 9·630257 | 2 9 | 10·369743 | 9·673929 | 2 11 | 10·326071 | 10·043673 | 2 2 | 9·956327 | 56 | 44 |
| 30 | 6 | 9·630391 | 3 13 | 10·369609 | 9·674093 | 3 16 | 10·325907 | 10·043702 | 3 3 | 9·956298 | 54 | 30 |
| 17 | 8 | 9·630524 | 4 18 | 10·369476 | 9·674257 | 4 22 | 10·325743 | 10·043732 | 4 4 | 9·956268 | 52 | 43 |
| 30 | 10 | 9·630658 | 5 22 | 10·369342 | 9·674420 | 5 27 | 10·325580 | 10·043762 | 5 5 | 9·956238 | 50 | 30 |
| 18 | 12 | 9·630792 | 6 27 | 10·369208 | 9·674584 | 6 33 | 10·325416 | 10·043792 | 6 6 | 9·956208 | 48 | 42 |
| 30 | 14 | 9·630925 | 7 31 | 10·369075 | 9·674747 | 7 38 | 10·325253 | 10·043822 | 7 7 | 9·956178 | 46 | 30 |
| 19 | 16 | 9·631059 | 8 36 | 10·368941 | 9·674911 | 8 44 | 10·325089 | 10·043852 | 8 8 | 9·956148 | 44 | 41 |
| 30 | 18 | 9·631192 | 9 40 | 10·368808 | 9·675074 | 9 49 | 10·324926 | 10·043882 | 9 9 | 9·956118 | 42 | 30 |
| 20 | 20 | 9·631326 | 10 44 | 10·368674 | 9·675237 | 10 54 | 10·324763 | 10·043911 | 10 10 | 9·956089 | 40 | 40 |
| 30 | 22 | 9·631459 | 11 49 | 10·368541 | 9·675401 | 11 60 | 10·324599 | 10·043941 | 11 11 | 9·956059 | 38 | 30 |
| 21 | 24 | 9·631593 | 12 53 | 10·368407 | 9·675564 | 12 65 | 10·324436 | 10·043971 | 12 12 | 9·956029 | 36 | 39 |
| 30 | 26 | 9·631726 | 13 58 | 10·368274 | 9·675727 | 13 71 | 10·324273 | 10·044001 | 13 13 | 9·955999 | 34 | 30 |
| 22 | 28 | 9·631859 | 14 62 | 10·368141 | 9·675890 | 14 76 | 10·324110 | 10·044031 | 14 14 | 9·955969 | 32 | 38 |
| 30 | 30 | 9·631992 | 15 67 | 10·368008 | 9·676053 | 15 82 | 10·323947 | 10·044061 | 15 15 | 9·955939 | 30 | 30 |
| 23 | 32 | 9·632125 | 16 71 | 10·367875 | 9·676217 | 16 87 | 10·323783 | 10·044091 | 16 16 | 9·955909 | 28 | 37 |
| 30 | 34 | 9·632259 | 17 75 | 10·367741 | 9·676380 | 17 92 | 10·323620 | 10·044121 | 17 17 | 9·955879 | 26 | 30 |
| 24 | 36 | 9·632392 | 18 80 | 10·367608 | 9·676543 | 18 98 | 10·323457 | 10·044151 | 18 18 | 9·955849 | 24 | 36 |
| 30 | 38 | 9·632525 | 19 84 | 10·367475 | 9·676706 | 19 103 | 10·323294 | 10·044181 | 19 19 | 9·955819 | 22 | 30 |
| 25 | 40 | 9·632658 | 20 89 | 10·367342 | 9·676869 | 20 109 | 10·323131 | 10·044211 | 20 20 | 9·955789 | 20 | 35 |
| 30 | 42 | 9·632790 | 21 93 | 10·367208 | 9·677032 | 21 114 | 10·322968 | 10·044241 | 21 21 | 9·955759 | 18 | 30 |
| 26 | 44 | 9·632923 | 22 98 | 10·367077 | 9·677194 | 22 120 | 10·322806 | 10·044271 | 22 22 | 9·955729 | 16 | 34 |
| 30 | 46 | 9·633056 | 23 102 | 10·366944 | 9·677357 | 23 125 | 10·322643 | 10·044301 | 23 23 | 9·955699 | 14 | 30 |
| 27 | 48 | 9·633189 | 24 107 | 10·366811 | 9·677520 | 24 131 | 10·322480 | 10·044331 | 24 24 | 9·955669 | 12 | 33 |
| 30 | 50 | 9·633322 | 25 111 | 10·366678 | 9·677683 | 25 136 | 10·322317 | 10·044361 | 25 25 | 9·955639 | 10 | 30 |
| 28 | 52 | 9·633454 | 26 116 | 10·366546 | 9·677846 | 26 141 | 10·322154 | 10·044391 | 26 26 | 9·955609 | 8 | 32 |
| 30 | 54 | 9·633587 | 27 120 | 10·366413 | 9·678008 | 27 47 | 10·321992 | 10·044421 | 27 27 | 9·955579 | 6 | 30 |
| 29 | 56 | 9·633719 | 28 125 | 10·366281 | 9·678171 | 28 152 | 10·321829 | 10·044452 | 28 28 | 9·955548 | 4 | 31 |
| 30 | 58 | 9·633852 | 29 129 | 10·366148 | 9·678334 | 29 158 | 10·321666 | 10·044482 | 29 29 | 9·955518 | 2 | 30 |
| 30 | **42** | 9·633984 | 30 133 | 10·366016 | 9·678496 | 30 163 | 10·321504 | 10·044512 | 30 30 | 9·955488 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

64° — 4h 18m

# TABLE XXVI.—(*continued*).

## LOG. SINES, COSINES, &c.

1ʰ 42ᵐ — 25°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·633984 | | 10·366016 | 9·678496 | | 10·321504 | 10·044512 | | 9·955488 | **18** | 30 |
| 30 | 2 | 9·634117 | 1″ 4 | 10·365883 | 9·678659 | 1″ 5 | 10·321341 | 10·044542 | 1″ 1 | 9·955458 | 58 | 30 |
| 31 | 4 | 9·634249 | 2 9 | 10·365751 | 9·678821 | 2 11 | 10·321179 | 10·044572 | 2 2 | 9·955428 | 56 | 29 |
| 30 | 6 | 9·634381 | 3 13 | 10·365619 | 9·678984 | 3 16 | 10·321016 | 10·044602 | 3 3 | 9·955398 | 54 | 30 |
| 32 | 8 | 9·634514 | 4 18 | 10·365486 | 9·679146 | 4 22 | 10·320854 | 10·044632 | 4 4 | 9·955368 | 52 | 28 |
| 30 | 10 | 9·634646 | 5 22 | 10·365354 | 9·679308 | 5 27 | 10·320692 | 10·044663 | 5 5 | 9·955337 | 50 | 30 |
| 33 | 12 | 9·634778 | 6 26 | 10·365222 | 9·679471 | 6 32 | 10·320529 | 10·044693 | 6 6 | 9·955307 | 48 | 27 |
| 30 | 14 | 9·634910 | 7 31 | 10·365090 | 9·679633 | 7 38 | 10·320367 | 10·044723 | 7 7 | 9·955277 | 46 | 30 |
| 34 | 16 | 9·635042 | 8 35 | 10·364958 | 9·679795 | 8 43 | 10·320205 | 10·044753 | 8 8 | 9·955247 | 44 | 26 |
| 30 | 18 | 9·635174 | 9 40 | 10·364826 | 9·679958 | 9 49 | 10·320042 | 10·044783 | 9 9 | 9·955217 | 42 | 30 |
| 35 | 20 | 9·635306 | 10 44 | 10·364694 | 9·680120 | 10 54 | 10·319880 | 10·044814 | 10 10 | 9·955186 | 40 | 25 |
| 30 | 22 | 9·635438 | 11 48 | 10·364562 | 9·680282 | 11 59 | 10·319718 | 10·044844 | 11 11 | 9·955156 | 38 | 30 |
| 36 | 24 | 9·635570 | 12 53 | 10·364430 | 9·680444 | 12 65 | 10·319556 | 10·044874 | 12 12 | 9·955126 | 36 | 24 |
| 30 | 26 | 9·635702 | 13 57 | 10·364298 | 9·680606 | 13 70 | 10·319394 | 10·044904 | 13 13 | 9·955096 | 34 | 30 |
| 37 | 28 | 9·635834 | 14 61 | 10·364166 | 9·680768 | 14 76 | 10·319232 | 10·044935 | 14 14 | 9·955065 | 32 | 23 |
| 30 | 30 | 9·635965 | 15 66 | 10·364035 | 9·680930 | 15 81 | 10·319070 | 10·044965 | 15 15 | 9·955035 | 30 | 30 |
| 38 | 32 | 9·636097 | 16 70 | 10·363903 | 9·681092 | 16 86 | 10·318908 | 10·044995 | 16 16 | 9·955005 | 28 | 22 |
| 30 | 34 | 9·636229 | 17 75 | 10·363771 | 9·681254 | 17 92 | 10·318746 | 10·045026 | 17 17 | 9·954974 | 26 | 30 |
| 39 | 36 | 9·636360 | 18 79 | 10·363640 | 9·681416 | 18 97 | 10·318584 | 10·045056 | 18 18 | 9·954944 | 24 | 21 |
| 30 | 38 | 9·636492 | 19 83 | 10·363508 | 9·681578 | 19 103 | 10·318422 | 10·045086 | 19 19 | 9·954914 | 22 | 30 |
| 40 | 40 | 9·636623 | 20 88 | 10·363377 | 9·681740 | 20 108 | 10·318260 | 10·045117 | 20 20 | 9·954883 | 20 | 20 |
| 30 | 42 | 9·636754 | 21 92 | 10·363246 | 9·681901 | 21 113 | 10·318099 | 10·045147 | 21 21 | 9·954853 | 18 | 30 |
| 41 | 44 | 9·636886 | 22 96 | 10·363114 | 9·682063 | 22 119 | 10·317937 | 10·045177 | 22 22 | 9·954823 | 16 | 19 |
| 30 | 46 | 9·637017 | 23 101 | 10·362983 | 9·682225 | 23 124 | 10·317775 | 10·045208 | 23 23 | 9·954792 | 14 | 30 |
| 42 | 48 | 9·637148 | 24 105 | 10·362852 | 9·682387 | 24 130 | 10·317613 | 10·045238 | 24 24 | 9·954762 | 12 | 18 |
| 30 | 50 | 9·637280 | 25 110 | 10·362720 | 9·682548 | 25 135 | 10·317452 | 10·045268 | 25 25 | 9·954732 | 10 | 30 |
| 43 | 52 | 9·637411 | 26 114 | 10·362589 | 9·682710 | 26 140 | 10·317290 | 10·045299 | 26 26 | 9·954701 | 8 | 17 |
| 30 | 54 | 9·637542 | 27 119 | 10·362458 | 9·682871 | 27 146 | 10·317129 | 10·045329 | 27 27 | 9·954671 | 6 | 30 |
| 44 | 56 | 9·637673 | 28 123 | 10·362327 | 9·683033 | 28 151 | 10·316967 | 10·045360 | 28 28 | 9·954640 | 4 | 16 |
| 30 | 58 | 9·637804 | 29 127 | 10·362196 | 9·683194 | 29 157 | 10·316806 | 10·045390 | 29 29 | 9·954610 | 2 | 30 |
| 45 | **43** | 9·637935 | 30 132 | 10·362065 | 9·683356 | 30 162 | 10·316644 | 10·045421 | 30 30 | 9·954579 | **17** | 15 |
| 30 | 2 | 9·638066 | 1 4 | 10·361934 | 9·683517 | 1 5 | 10·316483 | 10·045451 | 1 1 | 9·954549 | 58 | 30 |
| 46 | 4 | 9·638197 | 2 9 | 10·361803 | 9·683679 | 2 11 | 10·316321 | 10·045482 | 2 2 | 9·954518 | 56 | 14 |
| 30 | 6 | 9·638328 | 3 13 | 10·361672 | 9·683840 | 3 16 | 10·316160 | 10·045512 | 3 3 | 9·954488 | 54 | 30 |
| 47 | 8 | 9·638458 | 4 17 | 10·361542 | 9·684001 | 4 21 | 10·315999 | 10·045543 | 4 4 | 9·954457 | 52 | 13 |
| 30 | 10 | 9·638589 | 5 22 | 10·361411 | 9·684162 | 5 27 | 10·315838 | 10·045573 | 5 5 | 9·954427 | 50 | 30 |
| 48 | 12 | 9·638720 | 6 26 | 10·361280 | 9·684324 | 6 32 | 10·315676 | 10·045604 | 6 6 | 9·954396 | 48 | 12 |
| 30 | 14 | 9·638851 | 7 30 | 10·361149 | 9·684485 | 7 38 | 10·315515 | 10·045634 | 7 7 | 9·954366 | 46 | 30 |
| 49 | 16 | 9·638981 | 8 35 | 10·361019 | 9·684646 | 8 43 | 10·315354 | 10·045665 | 8 8 | 9·954335 | 44 | 11 |
| 30 | 18 | 9·639112 | 9 39 | 10·360888 | 9·684807 | 9 48 | 10·315193 | 10·045695 | 9 9 | 9·954305 | 42 | 30 |
| 50 | 20 | 9·639242 | 10 43 | 10·360758 | 9·684968 | 10 54 | 10·315032 | 10·045726 | 10 10 | 9·954274 | 40 | 10 |
| 30 | 22 | 9·639373 | 11 48 | 10·360627 | 9·685129 | 11 59 | 10·314871 | 10·045757 | 11 11 | 9·954243 | 38 | 30 |
| 51 | 24 | 9·639503 | 12 52 | 10·360497 | 9·685290 | 12 64 | 10·314710 | 10·045787 | 12 12 | 9·954213 | 36 | 9 |
| 30 | 26 | 9·639633 | 13 56 | 10·360367 | 9·685451 | 13 70 | 10·314549 | 10·045818 | 13 13 | 9·954182 | 34 | 30 |
| 52 | 28 | 9·639764 | 14 61 | 10·360236 | 9·685612 | 14 75 | 10·314388 | 10·045848 | 14 14 | 9·954152 | 32 | 8 |
| 30 | 30 | 9·639894 | 15 65 | 10·360106 | 9·685773 | 15 80 | 10·314227 | 10·045879 | 15 15 | 9·954121 | 30 | 30 |
| 53 | 32 | 9·640024 | 16 69 | 10·359976 | 9·685934 | 16 86 | 10·314066 | 10·045910 | 16 16 | 9·954090 | 28 | 7 |
| 30 | 34 | 9·640154 | 17 74 | 10·359846 | 9·686095 | 17 91 | 10·313905 | 10·045940 | 17 17 | 9·954060 | 26 | 30 |
| 54 | 36 | 9·640284 | 18 78 | 10·359716 | 9·686255 | 18 96 | 10·313745 | 10·045971 | 18 18 | 9·954029 | 24 | 6 |
| 30 | 38 | 9·640414 | 19 82 | 10·359586 | 9·686416 | 19 102 | 10·313584 | 10·046002 | 19 19 | 9·953998 | 22 | 30 |
| 55 | 40 | 9·640544 | 20 87 | 10·359456 | 9·686577 | 20 107 | 10·313423 | 10·046022 | 20 20 | 9·953968 | 20 | 5 |
| 30 | 42 | 9·640674 | 21 91 | 10·359326 | 9·686737 | 21 113 | 10·313263 | 10·046063 | 21 21 | 9·953937 | 18 | 30 |
| 56 | 44 | 9·640804 | 22 95 | 10·359196 | 9·686898 | 22 118 | 10·313102 | 10·046094 | 22 22 | 9·953906 | 16 | 4 |
| 30 | 46 | 9·640934 | 23 100 | 10·359066 | 9·687059 | 23 123 | 10·312941 | 10·046124 | 23 23 | 9·953876 | 14 | 30 |
| 57 | 48 | 9·641064 | 24 104 | 10·358936 | 9·687219 | 24 129 | 10·312781 | 10·046155 | 24 24 | 9·953845 | 12 | 3 |
| 30 | 50 | 9·641194 | 25 109 | 10·358806 | 9·687380 | 25 134 | 10·312620 | 10·046186 | 25 25 | 9·953814 | 10 | 30 |
| 58 | 52 | 9·641324 | 26 113 | 10·358676 | 9·687540 | 26 139 | 10·312460 | 10·046217 | 26 27 | 9·953783 | 8 | 2 |
| 30 | 54 | 9·641453 | 27 117 | 10·358547 | 9·687701 | 27 145 | 10·312299 | 10·046247 | 27 28 | 9·953753 | 6 | 30 |
| 59 | 56 | 9·641583 | 28 122 | 10·358417 | 9·687861 | 28 150 | 10·312139 | 10·046278 | 28 29 | 9·953722 | 4 | 1 |
| 30 | 58 | 9·641712 | 29 126 | 10·358288 | 9·688021 | 29 155 | 10·311979 | 10·046309 | 29 30 | 9·953691 | 2 | 30 |
| 60 | **44** | 9·641842 | 30 130 | 10·358158 | 9·688182 | 30 161 | 10·311818 | 10·046340 | 30 31 | 9·953660 | 0 | 0 |
| ′ ″ | m. s. | Cosine. | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

64° — 4ʰ 16ᵐ

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

$1^h\ 44^m$ 26°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·641842 | | 10·358158 | 9·688182 | | 10·311818 | 10·046340 | | 9·953660 | **16** | 60 |
| 30 | 2 | 9·641971 | 1″ 4 | 10·358029 | 9·688342 | 1″ 5 | 10·311658 | 10·046371 | 1″ 1 | 9·953629 | 58 | 30 |
| 1 | 4 | 9·642101 | 2 9 | 10·357899 | 9·688502 | 2 11 | 10·311498 | 10·046401 | 2 2 | 9·953599 | 56 | 59 |
| 30 | 6 | 9·642230 | 3 13 | 10·357770 | 9·688663 | 3 16 | 10·311337 | 10·046432 | 3 3 | 9·953568 | 54 | 30 |
| 2 | 8 | 9·642360 | 4 17 | 10·357640 | 9·688823 | 4 21 | 10·311177 | 10·046463 | 4 4 | 9·953537 | 52 | 58 |
| 30 | 10 | 9·642489 | 5 21 | 10·357511 | 9·688983 | 5 27 | 10·311017 | 10·046494 | 5 5 | 9·953506 | 50 | 30 |
| 3 | 12 | 9·642618 | 6 26 | 10·357382 | 9·689143 | 6 32 | 10·310857 | 10·046525 | 6 6 | 9·953475 | 48 | 57 |
| 30 | 14 | 9·642747 | 7 30 | 10·357253 | 9·689303 | 7 37 | 10·310697 | 10·046556 | 7 7 | 9·953444 | 46 | 30 |
| 4 | 16 | 9·642877 | 8 34 | 10·357123 | 9·689463 | 8 43 | 10·310537 | 10·046587 | 8 8 | 9·953413 | 44 | 56 |
| 30 | 18 | 9·643006 | 9 39 | 10·356994 | 9·689623 | 9 48 | 10·310377 | 10·046618 | 9 9 | 9·953382 | 42 | 30 |
| 5 | 20 | 9·643135 | 10 43 | 10·356865 | 9·689783 | 10 53 | 10·310217 | 10·046648 | 10 10 | 9·953352 | 40 | 55 |
| 30 | 22 | 9·643264 | 11 47 | 10·356736 | 9·689943 | 11 59 | 10·310057 | 10·046679 | 11 11 | 9·953321 | 38 | 30 |
| 6 | 24 | 9·643393 | 12 51 | 10·356607 | 9·690103 | 12 64 | 10·309897 | 10·046710 | 12 12 | 9·953290 | 36 | 54 |
| 30 | 26 | 9·643522 | 13 56 | 10·356478 | 9·690263 | 13 69 | 10·309737 | 10·046741 | 13 13 | 9·953259 | 34 | 30 |
| 7 | 28 | 9·643650 | 14 60 | 10·356350 | 9·690423 | 14 75 | 10·309577 | 10·046772 | 14 14 | 9·953228 | 32 | 53 |
| 30 | 30 | 9·643779 | 15 64 | 10·356221 | 9·690582 | 15 80 | 10·309418 | 10·046803 | 15 15 | 9·953197 | 30 | 30 |
| 8 | 32 | 9·643908 | 16 68 | 10·356092 | 9·690742 | 16 85 | 10·309258 | 10·046834 | 16 16 | 9·953166 | 28 | 52 |
| 30 | 34 | 9·644037 | 17 73 | 10·355963 | 9·690902 | 17 91 | 10·309098 | 10·046865 | 17 18 | 9·953135 | 26 | 30 |
| 9 | 36 | 9·644165 | 18 77 | 10·355835 | 9·691062 | 18 96 | 10·308938 | 10·046896 | 18 19 | 9·953104 | 24 | 51 |
| 30 | 38 | 9·644294 | 19 82 | 10·355706 | 9·691221 | 19 101 | 10·308779 | 10·046927 | 19 20 | 9·953073 | 22 | 30 |
| 10 | 40 | 9·644423 | 20 86 | 10·355577 | 9·691381 | 20 107 | 10·308619 | 10·046958 | 20 21 | 9·953042 | 20 | 50 |
| 30 | 42 | 9·644551 | 21 90 | 10·355449 | 9·691540 | 21 112 | 10·308460 | 10·046989 | 21 22 | 9·953011 | 18 | 30 |
| 11 | 44 | 9·644680 | 22 94 | 10·355320 | 9·691700 | 22 117 | 10·308300 | 10·047020 | 22 23 | 9·952980 | 16 | 49 |
| 30 | 46 | 9·644808 | 23 99 | 10·355192 | 9·691859 | 23 123 | 10·308141 | 10·047051 | 23 24 | 9·952949 | 14 | 30 |
| 12 | 48 | 9·644936 | 24 103 | 10·355064 | 9·692019 | 24 128 | 10·307981 | 10·047082 | 24 25 | 9·952918 | 12 | 48 |
| 30 | 50 | 9·645065 | 25 107 | 10·354935 | 9·692178 | 25 133 | 10·307822 | 10·047114 | 25 26 | 9 952886 | 10 | 30 |
| 13 | 52 | 9·645193 | 26 112 | 10·354807 | 9·692338 | 26 139 | 10·307662 | 10·047145 | 26 27 | 9·952855 | 8 | 47 |
| 30 | 54 | 9·645321 | 27 116 | 10·354679 | 9·692497 | 27 144 | 10·307503 | 10·047176 | 27 28 | 9·952824 | 6 | 30 |
| 14 | 56 | 9·645450 | 28 120 | 10·354550 | 9·692656 | 28 149 | 10·307344 | 10·047207 | 28 29 | 9·952793 | 4 | 46 |
| 30 | 58 | 9·645578 | 29 124 | 10·354422 | 9·692816 | 29 155 | 10·307184 | 10·047238 | 29 30 | 9·952762 | 2 | 30 |
| 15 | **45** | 9·645706 | 30 129 | 10·354294 | 9·692975 | 30 160 | 10·307025 | 10·047269 | 30 31 | 9·952731 | **15** | 45 |
| 30 | 2 | 9·645834 | 1 4 | 10·354166 | 9·693134 | 1 5 | 10·306866 | 10·047300 | 1 1 | 9·952700 | 58 | 30 |
| 16 | 4 | 9·645962 | 2 9 | 10·354038 | 9·693293 | 2 11 | 10·306707 | 10·047331 | 2 2 | 9·952669 | 56 | 44 |
| 30 | 6 | 9·646090 | 3 13 | 10·353910 | 9·693453 | 3 16 | 10·306547 | 10·047363 | 3 3 | 9·952637 | 54 | 30 |
| 17 | 8 | 9·646218 | 4 17 | 10·353782 | 9·693612 | 4 21 | 10·306388 | 10·047394 | 4 4 | 9·952606 | 52 | 43 |
| 30 | 10 | 9·646346 | 5 21 | 10·353654 | 9·693771 | 5 26 | 10·306229 | 10·047425 | 5 5 | 9·952575 | 50 | 30 |
| 18 | 12 | 9·646474 | 6 25 | 10·353526 | 9·693930 | 6 32 | 10·306070 | 10·047456 | 6 6 | 9·952544 | 48 | 42 |
| 30 | 14 | 9·646601 | 7 30 | 10·353399 | 9·694089 | 7 37 | 10·305911 | 10·047488 | 7 7 | 9·952512 | 46 | 30 |
| 19 | 16 | 9·646729 | 8 34 | 10·353271 | 9·694248 | 8 42 | 10·305752 | 10·047519 | 8 8 | 9·952481 | 44 | 41 |
| 30 | 18 | 9·646857 | 9 38 | 10·353143 | 9·694407 | 9 48 | 10·305593 | 10·047550 | 9 9 | 9·952450 | 42 | 30 |
| 20 | 20 | 9·646984 | 10 42 | 10·353016 | 9·694566 | 10 53 | 10·305434 | 10·047581 | 10 10 | 9·952419 | 40 | 40 |
| 30 | 22 | 9·647112 | 11 47 | 10·352888 | 9·694724 | 11 58 | 10·305276 | 10·047613 | 11 11 | 9·952387 | 38 | 30 |
| 21 | 24 | 9·647240 | 12 51 | 10·352760 | 9·694883 | 12 63 | 10·305117 | 10·047644 | 12 13 | 9·952356 | 36 | 39 |
| 30 | 26 | 9·647367 | 13 55 | 10·352633 | 9·695042 | 13 69 | 10·304958 | 10·047675 | 13 14 | 9·952325 | 34 | 30 |
| 22 | 28 | 9·647494 | 14 59 | 10·352506 | 9·695201 | 14 74 | 10·304799 | 10·047706 | 14 15 | 9·952294 | 32 | 38 |
| 30 | 30 | 9·647622 | 15 64 | 10·352378 | 9·695360 | 15 79 | 10·304640 | 10·047738 | 15 16 | 9·952262 | 30 | 30 |
| 23 | 32 | 9·647749 | 16 68 | 10·352251 | 9·695518 | 16 85 | 10·304482 | 10·047769 | 16 17 | 9·952231 | 28 | 37 |
| 30 | 34 | 9·647877 | 17 72 | 10·352123 | 9·695677 | 17 90 | 10·304323 | 10·047800 | 17 18 | 9·952200 | 26 | 30 |
| 24 | 36 | 9·648004 | 18 76 | 10·351996 | 9·695836 | 18 95 | 10·304164 | 10·047832 | 18 19 | 9·952168 | 24 | 36 |
| 30 | 38 | 9·648131 | 19 81 | 10·351869 | 9·695994 | 19 101 | 10·304006 | 10·047863 | 19 20 | 9·952137 | 22 | 30 |
| 25 | 40 | 9·648258 | 20 85 | 10·351742 | 9·696153 | 20 106 | 10·303847 | 10·047894 | 20 21 | 9·952106 | 20 | 35 |
| 30 | 42 | 9·648385 | 21 89 | 10·351615 | 9·696311 | 21 111 | 10·303689 | 10·047926 | 21 22 | 9·952074 | 18 | 30 |
| 26 | 44 | 9·648512 | 22 93 | 10·351488 | 9·696470 | 22 116 | 10·303530 | 10·047957 | 22 23 | 9·952043 | 16 | 34 |
| 30 | 46 | 9·648639 | 23 98 | 10·351361 | 9·696628 | 23 122 | 10·303372 | 10·047989 | 23 24 | 9·952011 | 14 | 30 |
| 27 | 48 | 9·648766 | 24 102 | 10·351234 | 9·696787 | 24 127 | 10·303213 | 10·048020 | 24 25 | 9·951980 | 12 | 33 |
| 30 | 50 | 9·648893 | 25 106 | 10·351107 | 9·696945 | 25 132 | 10·303055 | 10·048051 | 25 26 | 9·951949 | 10 | 30 |
| 28 | 52 | 9·649020 | 26 110 | 10·350980 | 9·697103 | 26 138 | 10·302897 | 10·048083 | 26 27 | 9·951917 | 8 | 32 |
| 30 | 54 | 9·649147 | 27 115 | 10·350853 | 9·697262 | 27 143 | 10·302739 | 10·048114 | 27 28 | 9·951886 | 6 | 30 |
| 29 | 56 | 9·649274 | 28 119 | 10·350726 | 9·697420 | 28 148 | 10·302580 | 10·048146 | 28 29 | 9·951854 | 4 | 31 |
| 30 | 58 | 9·649401 | 29 123 | 10·350599 | 9·697578 | 29 153 | 10·302422 | 10·048177 | 29 30 | 9·951823 | 2 | 30 |
| 30 | **46** | 9·649527 | 30 127 | 10·350473 | 9·697736 | 30 159 | 10·302264 | 10·048209 | 30 31 | 9·951791 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

63° $4^h\ 14^m$

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

| 1h 46m | | | | | | 26° | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | | Cosec. | Tangent | Parts | | Cotang. | Secant | Parts | | Cosine | m. s. | ′ ″ |
| 30 | 0 | 9·649527 | | | 10·350473 | 9·697736 | | | 10·302264 | 10·048209 | | | 9·951791 | 14 | 30 |
| 30 | 2 | 9·649654 | 1″ | 4 | 10·350346 | 9·697894 | 1″ | 5 | 10·302106 | 10·048240 | 1″ | 1 | 9·951760 | 58 | 30 |
| 31 | 4 | 9·649781 | 2 | 8 | 10·350219 | 9·698053 | 2 | 11 | 10·301947 | 10·048272 | 2 | 2 | 9·951728 | 56 | 29 |
| 30 | 6 | 9·649907 | 3 | 13 | 10·350093 | 9·698211 | 3 | 16 | 10·301789 | 10·048303 | 3 | 3 | 9·951697 | 54 | 30 |
| 32 | 8 | 9·650034 | 4 | 17 | 10·349966 | 9·698369 | 4 | 21 | 10·301631 | 10·048335 | 4 | 4 | 9·951665 | 52 | 28 |
| 30 | 10 | 9·650160 | 5 | 21 | 10·349840 | 9·698527 | 5 | 26 | 10·301473 | 10·048366 | 5 | 5 | 9·951634 | 50 | 30 |
| 33 | 12 | 9·650287 | 6 | 25 | 10·349713 | 9·698685 | 6 | 32 | 10·301315 | 10·048398 | 6 | 6 | 9·951602 | 48 | 27 |
| 30 | 14 | 9·650413 | 7 | 29 | 10·349587 | 9·698843 | 7 | 37 | 10·301157 | 10·048430 | 7 | 7 | 9·951570 | 46 | 30 |
| 34 | 16 | 9·650539 | 8 | 34 | 10·349461 | 9·699001 | 8 | 42 | 10·300999 | 10·048461 | 8 | 8 | 9·951539 | 44 | 26 |
| 30 | 18 | 9·650666 | 9 | 38 | 10·349334 | 9·699159 | 9 | 47 | 10·300841 | 10·048493 | 9 | 9 | 9·951507 | 42 | 30 |
| 35 | 20 | 9·650792 | 10 | 42 | 10·349208 | 9·699316 | 10 | 53 | 10·300684 | 10·048524 | 10 | 11 | 9·951476 | 40 | 25 |
| 30 | 22 | 9·650918 | 11 | 46 | 10·349082 | 9·699474 | 11 | 58 | 10·300526 | 10·048556 | 11 | 12 | 9·951444 | 38 | 30 |
| 36 | 24 | 9·651044 | 12 | 51 | 10·348956 | 9·699632 | 12 | 63 | 10·300368 | 10·048588 | 12 | 13 | 9·951412 | 36 | 24 |
| 30 | 26 | 9·651171 | 13 | 55 | 10·348829 | 9·699790 | 13 | 68 | 10·300210 | 10·048619 | 13 | 14 | 9·951381 | 34 | 30 |
| 37 | 28 | 9·651297 | 14 | 59 | 10·348703 | 9·699947 | 14 | 74 | 10·300053 | 10·048651 | 14 | 15 | 9·951349 | 32 | 23 |
| 30 | 30 | 9·651423 | 15 | 63 | 10·348577 | 9·700105 | 15 | 79 | 10·299895 | 10·048683 | 15 | 16 | 9·951317 | 30 | 30 |
| 38 | 32 | 9·651549 | 16 | 67 | 10·348451 | 9·700263 | 16 | 84 | 10·299737 | 10·048714 | 16 | 17 | 9·951286 | 28 | 22 |
| 30 | 34 | 9·651675 | 17 | 71 | 10·348325 | 9·700420 | 17 | 89 | 10·299580 | 10·048746 | 17 | 18 | 9·951254 | 26 | 30 |
| 39 | 36 | 9·651800 | 18 | 76 | 10·348200 | 9·700578 | 18 | 95 | 10·299422 | 10·048778 | 18 | 19 | 9·951222 | 24 | 21 |
| 30 | 38 | 9·651926 | 19 | 80 | 10·348074 | 9·700736 | 19 | 100 | 10·299264 | 10·048809 | 19 | 20 | 9·951191 | 22 | 30 |
| 40 | 40 | 9·652052 | 20 | 84 | 10·347948 | 9·700893 | 20 | 105 | 10·299107 | 10·048841 | 20 | 21 | 9·951159 | 20 | 20 |
| 30 | 42 | 9·652178 | 21 | 88 | 10·347822 | 9·701051 | 21 | 110 | 10·298949 | 10·048873 | 21 | 22 | 9·951127 | 18 | 30 |
| 41 | 44 | 9·652304 | 22 | 92 | 10·347696 | 9·701208 | 22 | 116 | 10·298792 | 10·048904 | 22 | 23 | 9·951096 | 16 | 19 |
| 30 | 46 | 9·652429 | 23 | 97 | 10·347571 | 9·701365 | 23 | 121 | 10·298635 | 10·048936 | 23 | 24 | 9·951064 | 14 | 30 |
| 42 | 48 | 9·652555 | 24 | 101 | 10·347445 | 9·701523 | 24 | 126 | 10·298477 | 10·048968 | 24 | 25 | 9·951032 | 12 | 18 |
| 30 | 50 | 9·652680 | 25 | 105 | 10·347320 | 9·701680 | 25 | 131 | 10·298320 | 10·049000 | 25 | 26 | 9·951000 | 10 | 30 |
| 43 | 52 | 9·652806 | 26 | 109 | 10·347194 | 9·701837 | 26 | 137 | 10·298163 | 10·049032 | 26 | 27 | 9·950968 | 8 | 17 |
| 30 | 54 | 9·652931 | 27 | 113 | 10·347069 | 9·701995 | 27 | 142 | 10·298005 | 10·049063 | 27 | 28 | 9·950937 | 6 | 30 |
| 44 | 56 | 9·653057 | 28 | 118 | 10·346943 | 9·702152 | 28 | 147 | 10·297848 | 10·049095 | 28 | 29 | 9·950905 | 4 | 16 |
| 30 | 58 | 9·653182 | 29 | 122 | 10·346818 | 9·702309 | 29 | 153 | 10·297691 | 10·049127 | 29 | 31 | 9·950873 | 2 | 30 |
| 45 | 47 | 9·653308 | 30 | 126 | 10·346692 | 9·702466 | 30 | 158 | 10·297534 | 10·049159 | 30 | 32 | 9·950841 | 13 | 15 |
| 30 | 2 | 9·653433 | 1 | 4 | 10·346567 | 9·702623 | 1 | 5 | 10·297377 | 10·049191 | 1 | 1 | 9·950809 | 58 | 30 |
| 46 | 4 | 9·653558 | 2 | 8 | 10·346442 | 9·702781 | 2 | 10 | 10·297219 | 10·049222 | 2 | 2 | 9·950778 | 56 | 14 |
| 30 | 6 | 9·653683 | 3 | 12 | 10·346317 | 9·702938 | 3 | 16 | 10·297062 | 10·049254 | 3 | 3 | 9·950746 | 54 | 30 |
| 47 | 8 | 9·653808 | 4 | 17 | 10·346192 | 9·703095 | 4 | 21 | 10·296905 | 10·049286 | 4 | 4 | 9·950714 | 52 | 13 |
| 30 | 10 | 9·653934 | 5 | 21 | 10·346066 | 9·703252 | 5 | 26 | 10·296748 | 10·049318 | 5 | 5 | 9·950682 | 50 | 30 |
| 48 | 12 | 9·654059 | 6 | 25 | 10·345941 | 9·703409 | 6 | 31 | 10·296591 | 10·049350 | 6 | 6 | 9·950650 | 48 | 12 |
| 30 | 14 | 9·654184 | 7 | 29 | 10·345816 | 9·703566 | 7 | 37 | 10·296434 | 10·049382 | 7 | 7 | 9·950618 | 46 | 30 |
| 49 | 16 | 9·654309 | 8 | 33 | 10·345691 | 9·703722 | 8 | 42 | 10·296278 | 10·049414 | 8 | 9 | 9·950586 | 44 | 11 |
| 30 | 18 | 9·654434 | 9 | 37 | 10·345566 | 9·703879 | 9 | 47 | 10·296121 | 10·049446 | 9 | 10 | 9·950554 | 42 | 30 |
| 50 | 20 | 9·654558 | 10 | 42 | 10·345442 | 9·704036 | 10 | 52 | 10·295964 | 10·049478 | 10 | 11 | 9·950522 | 40 | 10 |
| 30 | 22 | 9·654683 | 11 | 46 | 10·345317 | 9·704193 | 11 | 57 | 10·295807 | 10·049510 | 11 | 12 | 9·950490 | 38 | 30 |
| 51 | 24 | 9·654808 | 12 | 50 | 10·345192 | 9·704350 | 12 | 63 | 10·295650 | 10·049542 | 12 | 13 | 9·950458 | 36 | 9 |
| 30 | 26 | 9·654933 | 13 | 54 | 10·345067 | 9·704506 | 13 | 68 | 10·295494 | 10·049574 | 13 | 14 | 9·950426 | 34 | 30 |
| 52 | 28 | 9·655058 | 14 | 58 | 10·344942 | 9·704663 | 14 | 73 | 10·295337 | 10·049606 | 14 | 15 | 9·950394 | 32 | 8 |
| 30 | 30 | 9·655182 | 15 | 62 | 10·344818 | 9·704820 | 15 | 78 | 10·295180 | 10·049638 | 15 | 16 | 9·950362 | 30 | 30 |
| 53 | 32 | 9·655307 | 16 | 67 | 10·344693 | 9·704976 | 16 | 84 | 10·295024 | 10·049670 | 16 | 17 | 9·950330 | 28 | 7 |
| 30 | 34 | 9·655431 | 17 | 71 | 10·344569 | 9·705133 | 17 | 89 | 10·294867 | 10·049702 | 17 | 18 | 9·950298 | 26 | 30 |
| 54 | 36 | 9·655556 | 18 | 75 | 10·344444 | 9·705290 | 18 | 94 | 10·294710 | 10·049734 | 18 | 19 | 9·950266 | 24 | 6 |
| 30 | 38 | 9·655680 | 19 | 79 | 10·344320 | 9·705446 | 19 | 99 | 10·294554 | 10·049766 | 19 | 20 | 9·950234 | 22 | 30 |
| 55 | 40 | 9·655805 | 20 | 83 | 10·344195 | 9·705603 | 20 | 104 | 10·294397 | 10·049798 | 20 | 21 | 9·950202 | 20 | 5 |
| 30 | 42 | 9·655929 | 21 | 87 | 10·344071 | 9·705759 | 21 | 110 | 10·294241 | 10·049830 | 21 | 22 | 9·950170 | 18 | 30 |
| 56 | 44 | 9·656054 | 22 | 91 | 10·343946 | 9·705916 | 22 | 115 | 10·294084 | 10·049862 | 22 | 23 | 9·950138 | 16 | 4 |
| 30 | 46 | 9·656178 | 23 | 95 | 10·343822 | 9·706072 | 23 | 120 | 10·293928 | 10·049894 | 23 | 25 | 9·950106 | 14 | 30 |
| 57 | 48 | 9·656302 | 24 | 100 | 10·343698 | 9·706228 | 24 | 125 | 10·293772 | 10·049926 | 24 | 26 | 9·950074 | 12 | 3 |
| 30 | 50 | 9·656426 | 25 | 104 | 10·343574 | 9·706385 | 25 | 130 | 10·293615 | 10·049958 | 25 | 27 | 9·950042 | 10 | 30 |
| 58 | 52 | 9·656551 | 26 | 108 | 10·343449 | 9·706541 | 26 | 136 | 10·293459 | 10·049990 | 26 | 28 | 9·950010 | 8 | 2 |
| 30 | 54 | 9·656675 | 27 | 112 | 10·343325 | 9·706697 | 27 | 141 | 10·293303 | 10·050023 | 27 | 29 | 9·949977 | 6 | 30 |
| 59 | 56 | 9·656799 | 28 | 116 | 10·343201 | 9·706854 | 28 | 146 | 10·293146 | 10·050055 | 28 | 30 | 9·949945 | 4 | 1 |
| 30 | 58 | 9·656923 | 29 | 120 | 10·343077 | 9·707010 | 29 | 151 | 10·292990 | 10·050087 | 29 | 31 | 9·949913 | 2 | 30 |
| 60 | 48 | 9·657047 | 30 | 125 | 10·342953 | 9·707166 | 30 | 157 | 10·292834 | 10·050119 | 30 | 32 | 9·949881 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | | Secant | Cotang. | Parts | | Tangent | Cosec. | Parts | | Sine | m. s. | ′ ″ |
| | | | | | | 63° | | | | | | | 4h 12m | | |

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES. &c.

1ʰ 48ᵐ — 27°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·657047 | | 10·342953 | 9·707166 | | 10·292834 | 10·050119 | | 9·949881 | **12** | 60 |
| 30 | 2 | 9·657171 | 1″ 4 | 10·342829 | 9·707322 | 1″ 5 | 10·292678 | 10·050151 | 1″ 1 | 9·949849 | 58 | 30 |
| 1 | 4 | 9·657295 | 2 8 | 10·342705 | 9·707478 | 2 10 | 10·292522 | 10·050184 | 2 2 | 9·949816 | 56 | 59 |
| 30 | 6 | 9·657418 | 3 12 | 10·342582 | 9·707634 | 3 16 | 10·292366 | 10·050216 | 3 3 | 9·949784 | 54 | 30 |
| 2 | 8 | 9·657542 | 4 16 | 10·342458 | 9·707790 | 4 21 | 10·292210 | 10·050248 | 4 4 | 9·949752 | 52 | 58 |
| 30 | 10 | 9·657666 | 5 21 | 10·342334 | 9·707946 | 5 26 | 10·292054 | 10·050280 | 5 5 | 9·949720 | 50 | 30 |
| 3 | 12 | 9·657790 | 6 25 | 10·342210 | 9·708102 | 6 31 | 10·291898 | 10·050312 | 6 6 | 9·949688 | 48 | 57 |
| 30 | 14 | 9·657913 | 7 29 | 10·342087 | 9·708258 | 7 36 | 10·291742 | 10·050345 | 7 8 | 9·949655 | 46 | 30 |
| 4 | 16 | 9·658037 | 8 33 | 10·341963 | 9·708414 | 8 42 | 10·291586 | 10·050377 | 8 9 | 9·949623 | 44 | 56 |
| 30 | 18 | 9·658161 | 9 37 | 10·341839 | 9·708570 | 9 47 | 10·291430 | 10·050409 | 9 10 | 9·949591 | 42 | 30 |
| 5 | 20 | 9·658284 | 10 41 | 10·341716 | 9·708726 | 10 52 | 10·291274 | 10·050442 | 10 11 | 9·949558 | 40 | 55 |
| 30 | 22 | 9·658408 | 11 45 | 10·341592 | 9·708882 | 11 57 | 10·291118 | 10·050474 | 11 12 | 9·949526 | 38 | 30 |
| 6 | 24 | 9·658531 | 12 49 | 10·341469 | 9·709037 | 12 62 | 10·2909[illegible] | 10·050506 | 12 13 | 9·949494 | 36 | 54 |
| 30 | 26 | 9·658655 | 13 53 | 10·341345 | 9·709193 | 13 67 | 10·290807 | 10·050538 | 13 14 | 9·949462 | 34 | 30 |
| 7 | 28 | 9·658778 | 14 57 | 10·341222 | 9·709349 | 14 73 | 10·290651 | 10·050571 | 14 15 | 9·949429 | 32 | 53 |
| 30 | 30 | 9·658901 | 15 62 | 10·341099 | 9·709504 | 15 78 | 10·290496 | 10·050603 | 15 16 | 9·949397 | 30 | 30 |
| 8 | 32 | 9·659025 | 16 66 | 10·340975 | 9·709660 | 16 83 | 10·290340 | 10·050636 | 16 17 | 9·949364 | 28 | 52 |
| 30 | 34 | 9·659148 | 17 70 | 10·340852 | 9·709816 | 17 88 | 10·290184 | 10·050668 | 17 18 | 9·949332 | 26 | 30 |
| 9 | 36 | 9·659271 | 18 74 | 10·340729 | 9·709971 | 18 93 | 10·290029 | 10·050700 | 18 19 | 9·949300 | 24 | 51 |
| 30 | 38 | 9·659394 | 19 78 | 10·340606 | 9·710127 | 19 99 | 10·289873 | 10·050733 | 19 21 | 9·949267 | 22 | 30 |
| 10 | 40 | 9·659517 | 20 82 | 10·340483 | 9·710282 | 20 104 | 10·289718 | 10·050765 | 20 22 | 9·949235 | 20 | 50 |
| 30 | 42 | 9·659640 | 21 86 | 10·340360 | 9·710438 | 21 109 | 10·289562 | 10·050798 | 21 23 | 9·949202 | 18 | 30 |
| 11 | 44 | 9·659763 | 22 90 | 10·340237 | 9·710593 | 22 114 | 10·289407 | 10·050830 | 22 24 | 9·949170 | 16 | 49 |
| 30 | 46 | 9·659886 | 23 95 | 10·340114 | 9·710749 | 23 119 | 10·289251 | 10·050862 | 23 25 | 9·949138 | 14 | 30 |
| 12 | 48 | 9·660009 | 24 99 | 10·339991 | 9·710904 | 24 125 | 10·289096 | 10·050895 | 24 26 | 9·949105 | 12 | 48 |
| 30 | 50 | 9·660132 | 25 103 | 10·339868 | 9·711059 | 25 130 | 10·288941 | 10·050927 | 25 27 | 9·949073 | 10 | 30 |
| 13 | 52 | 9·660255 | 26 107 | 10·339745 | 9·711215 | 26 135 | 10·288785 | 10·050960 | 26 28 | 9·949040 | 8 | 47 |
| 30 | 54 | 9·660378 | 27 111 | 10·339622 | 9·711370 | 27 140 | 10·288630 | 10·050992 | 27 29 | 9·949008 | 6 | 30 |
| 14 | 56 | 9·660501 | 28 115 | 10·339499 | 9·711525 | 28 145 | 10·288475 | 10·051025 | 28 30 | 9·948975 | 4 | 46 |
| 30 | 58 | 9·660623 | 29 119 | 10·339377 | 9·711681 | 29 151 | 10·288319 | 10·051057 | 29 31 | 9·948943 | 2 | 30 |
| 15 | **49** | 9·660746 | 30 123 | 10·339254 | 9·711836 | 30 156 | 10·288164 | 10·051090 | 30 32 | 9·948910 | **11** | 45 |
| 30 | 2 | 9·660869 | 1 4 | 10·339131 | 9·711991 | 1 5 | 10·288009 | 10·051122 | 1 1 | 9·948878 | 58 | 30 |
| 16 | 4 | 9·660991 | 2 8 | 10·339009 | 9·712146 | 2 10 | 10·287854 | 10·051155 | 2 2 | 9·948845 | 56 | 44 |
| 30 | 6 | 9·661114 | 3 12 | 10·338886 | 9·712301 | 3 15 | 10·287699 | 10·051188 | 3 3 | 9·948812 | 54 | 30 |
| 17 | 8 | 9·661236 | 4 16 | 10·338764 | 9·712456 | 4 21 | 10·287544 | 10·051220 | 4 4 | 9·948780 | 52 | 43 |
| 30 | 10 | 9·661359 | 5 20 | 10·338641 | 9·712611 | 5 26 | 10·287389 | 10·051253 | 5 5 | 9·948747 | 50 | 30 |
| 18 | 12 | 9·661481 | 6 24 | 10·338519 | 9·712766 | 6 31 | 10·287234 | 10·051285 | 6 7 | 9·948715 | 48 | 42 |
| 30 | 14 | 9·661603 | 7 28 | 10·338397 | 9·712921 | 7 36 | 10·287079 | 10·051318 | 7 8 | 9·948682 | 46 | 30 |
| 19 | 16 | 9·661726 | 8 33 | 10·338274 | 9·713076 | 8 41 | 10·286924 | 10·051350 | 8 9 | 9·948650 | 44 | 41 |
| 30 | 18 | 9·661848 | 9 37 | 10·338152 | 9·713231 | 9 46 | 10·286769 | 10·051383 | 9 10 | 9·948617 | 42 | 30 |
| 20 | 20 | 9·661970 | 10 41 | 10·338030 | 9·713386 | 10 52 | 10·286614 | 10·051416 | 10 11 | 9·948584 | 40 | 40 |
| 30 | 22 | 9·662092 | 11 45 | 10·337908 | 9·713541 | 11 57 | 10·286459 | 10·051448 | 11 12 | 9·948552 | 38 | 30 |
| 21 | 24 | 9·662214 | 12 49 | 10·337786 | 9·713696 | 12 62 | 10·286304 | 10·051481 | 12 13 | 9·948519 | 36 | 39 |
| 30 | 26 | 9·662337 | 13 53 | 10·337663 | 9·713850 | 13 67 | 10·286150 | 10·051514 | 13 14 | 9·948486 | 34 | 30 |
| 22 | 28 | 9·662459 | 14 57 | 10·337541 | 9·714005 | 14 72 | 10·285995 | 10·051546 | 14 15 | 9·948454 | 32 | 38 |
| 30 | 30 | 9·662581 | 15 61 | 10·337419 | 9·714160 | 15 77 | 10·285840 | 10·051579 | 15 16 | 9·948421 | 30 | 30 |
| 23 | 32 | 9·662703 | 16 65 | 10·337297 | 9·714314 | 16 83 | 10·285686 | 10·051612 | 16 17 | 9·948388 | 28 | 37 |
| 30 | 34 | 9·662825 | 17 69 | 10·337175 | 9·714469 | 17 88 | 10·285531 | 10·051645 | 17 18 | 9·948355 | 26 | 30 |
| 24 | 36 | 9·662946 | 18 73 | 10·337054 | 9·714624 | 18 93 | 10·285376 | 10·051677 | 18 19 | 9·948323 | 24 | 36 |
| 30 | 38 | 9·663068 | 19 77 | 10·336932 | 9·714778 | 19 98 | 10·285222 | 10·051710 | 19 21 | 9·948290 | 22 | 30 |
| 25 | 40 | 9·663190 | 20 81 | 10·336810 | 9·714933 | 20 103 | 10·285067 | 10·051743 | 20 22 | 9·948257 | 20 | 35 |
| 30 | 42 | 9·663312 | 21 85 | 10·336688 | 9·715087 | 21 108 | 10·284913 | 10·051776 | 21 23 | 9·948224 | 18 | 30 |
| 26 | 44 | 9·663433 | 22 89 | 10·336567 | 9·715242 | 22 114 | 10·284758 | 10·051808 | 22 24 | 9·948192 | 16 | 34 |
| 30 | 46 | 9·663555 | 23 94 | 10·336445 | 9·715396 | 23 119 | 10·284604 | 10·051841 | 23 25 | 9·948159 | 14 | 30 |
| 27 | 48 | 9·663677 | 24 98 | 10·336323 | 9·715551 | 24 124 | 10·284449 | 10·051874 | 24 26 | 9·948126 | 12 | 33 |
| 30 | 50 | 9·663798 | 25 102 | 10·336202 | 9·715705 | 25 129 | 10·284295 | 10·051907 | 25 27 | 9·948093 | 10 | 30 |
| 28 | 52 | 9·663920 | 26 106 | 10·336080 | 9·715860 | 26 134 | 10·284140 | 10·051940 | 26 28 | 9·948060 | 8 | 32 |
| 30 | 54 | 9·664041 | 27 110 | 10·335959 | 9·716014 | 27 139 | 10·283986 | 10·051972 | 27 29 | 9·948028 | 6 | 30 |
| 29 | 56 | 9·664163 | 28 114 | 10·335837 | 9·716168 | 28 144 | 10·283832 | 10·052005 | 28 31 | 9·947995 | 4 | 31 |
| 30 | 58 | 9·664284 | 29 118 | 10·335716 | 9·716322 | 29 150 | 10·283678 | 10·052038 | 29 32 | 9·947962 | 2 | 30 |
| 30 | 50 | 9·664406 | 30 122 | 10·335594 | 9·716477 | 30 155 | 10·283523 | 10·052071 | 30 33 | 9·947929 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

62° — 4ʰ 10ᵐ

## TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

1h 50m — 27°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·664406 | | 10·335594 | 9·716477 | | 10·283523 | 10·052071 | | 9·947929 | 10 | 30 |
| 30 | 2 | 9·664527 | 1″ 4 | 10·335473 | 9·716631 | 1″ 5 | 10·283369 | 10·052104 | 1″ 1 | 9·947896 | 58 | 30 |
| 31 | 4 | 9·664648 | 2 8 | 10·335352 | 9·716785 | 2 10 | 10·283215 | 10·052137 | 2 2 | 9·947863 | 56 | 29 |
| 30 | 6 | 9·664769 | 3 12 | 10·335231 | 9·716939 | 3 15 | 10·283061 | 10·052170 | 3 3 | 9·947830 | 54 | 30 |
| 32 | 8 | 9·664891 | 4 16 | 10·335109 | 9·717093 | 4 20 | 10·282907 | 10·052203 | 4 4 | 9·947797 | 52 | 28 |
| 30 | 10 | 9·665012 | 5 20 | 10·334988 | 9·717247 | 5 26 | 10·282753 | 10·052236 | 5 5 | 9·947764 | 50 | 30 |
| 33 | 12 | 9·665133 | 6 24 | 10·334867 | 9·717401 | 6 31 | 10·282599 | 10·052269 | 6 7 | 9·947731 | 48 | 27 |
| 30 | 14 | 9·665254 | 7 28 | 10·334746 | 9·717555 | 7 36 | 10·282445 | 10·052302 | 7 8 | 9·947698 | 46 | 30 |
| 34 | 16 | 9·665375 | 8 32 | 10·334625 | 9·717709 | 8 41 | 10·282291 | 10·052335 | 8 9 | 9·947665 | 44 | 26 |
| 30 | 18 | 9·665496 | 9 36 | 10·334504 | 9·717863 | 9 46 | 10·282137 | 10·052367 | 9 10 | 9·947633 | 42 | 30 |
| 35 | 20 | 9·665617 | 10 40 | 10·334383 | 9·718017 | 10 51 | 10·281983 | 10·052400 | 10 11 | 9·947600 | 40 | 25 |
| 30 | 22 | 9·665738 | 11 44 | 10·334262 | 9·718171 | 11 56 | 10·281829 | 10·052433 | 11 12 | 9·947567 | 38 | 30 |
| 36 | 24 | 9·665859 | 12 48 | 10·334141 | 9·718325 | 12 61 | 10·281675 | 10·052467 | 12 13 | 9·947533 | 36 | 24 |
| 30 | 26 | 9·665979 | 13 52 | 10·334021 | 9·718479 | 13 67 | 10·281521 | 10·052500 | 13 14 | 9·947500 | 34 | 30 |
| 37 | 28 | 9·666100 | 14 56 | 10·333900 | 9·718633 | 14 72 | 10·281367 | 10·052533 | 14 15 | 9·947467 | 32 | 23 |
| 30 | 30 | 9·666221 | 15 60 | 10·333779 | 9·718786 | 15 77 | 10·281214 | 10·052566 | 15 16 | 9·947434 | 30 | 30 |
| 38 | 32 | 9·666342 | 16 64 | 10·333658 | 9·718940 | 16 82 | 10·281060 | 10·052599 | 16 18 | 9·947401 | 28 | 22 |
| 30 | 34 | 9·666462 | 17 68 | 10·333538 | 9·719094 | 17 87 | 10·280906 | 10·052632 | 17 19 | 9·947368 | 26 | 30 |
| 39 | 36 | 9·666583 | 18 72 | 10·333417 | 9·719248 | 18 92 | 10·280752 | 10·052665 | 18 20 | 9·947335 | 24 | 21 |
| 30 | 38 | 9·666703 | 19 76 | 10·333297 | 9·719401 | 19 97 | 10·280599 | 10·052698 | 19 21 | 9·947302 | 22 | 30 |
| 40 | 40 | 9·666824 | 20 80 | 10·333176 | 9·719555 | 20 102 | 10·280445 | 10·052731 | 20 22 | 9·947269 | 20 | 20 |
| 30 | 42 | 9·666944 | 21 84 | 10·333056 | 9·719708 | 21 108 | 10·280292 | 10·052764 | 21 23 | 9·947236 | 18 | 30 |
| 41 | 44 | 9·667065 | 22 88 | 10·332935 | 9·719862 | 22 113 | 10·280138 | 10·052797 | 22 24 | 9·947203 | 16 | 19 |
| 30 | 46 | 9·667185 | 23 92 | 10·332815 | 9·720016 | 23 118 | 10·279984 | 10·052830 | 23 25 | 9·947170 | 14 | 30 |
| 42 | 48 | 9·667305 | 24 96 | 10·332695 | 9·720169 | 24 123 | 10·279831 | 10·052864 | 24 26 | 9·947136 | 12 | 18 |
| 30 | 50 | 9·667426 | 25 101 | 10·332574 | 9·720322 | 25 128 | 10·279678 | 10·052897 | 25 28 | 9·947103 | 10 | 30 |
| 43 | 52 | 9·667546 | 26 105 | 10·332454 | 9·720476 | 26 133 | 10·279524 | 10·052930 | 26 29 | 9·947070 | 8 | 17 |
| 30 | 54 | 9·667666 | 27 109 | 10·332334 | 9·720629 | 27 138 | 10·279371 | 10·052963 | 27 30 | 9·947037 | 6 | 30 |
| 44 | 56 | 9·667786 | 28 113 | 10·332214 | 9·720783 | 28 143 | 10·279217 | 10·052996 | 28 31 | 9·947004 | 4 | 16 |
| 30 | 58 | 9·667906 | 29 117 | 10·332094 | 9·720936 | 29 148 | 10·279064 | 10·053030 | 29 32 | 9·946970 | 2 | 30 |
| 45 | 51 | 9·668027 | 30 121 | 10·331973 | 9·721089 | 30 154 | 10·278911 | 10·053063 | 30 33 | 9·946937 | 9 | 15 |
| 30 | 2 | 9·668147 | 1 4 | 10·331853 | 9·721243 | 1 5 | 10·278757 | 10·053096 | 1 1 | 9·946904 | 58 | 30 |
| 46 | 4 | 9·668267 | 2 8 | 10·331733 | 9·721396 | 2 10 | 10·278604 | 10·053129 | 2 2 | 9·946871 | 56 | 14 |
| 30 | 6 | 9·668386 | 3 12 | 10·331614 | 9·721549 | 3 15 | 10·278451 | 10·053163 | 3 3 | 9·946837 | 54 | 30 |
| 47 | 8 | 9·668506 | 4 16 | 10·331494 | 9·721702 | 4 20 | 10·278298 | 10·053196 | 4 4 | 9·946804 | 52 | 13 |
| 30 | 10 | 9·668626 | 5 20 | 10·331374 | 9·721855 | 5 25 | 10·278145 | 10·053229 | 5 6 | 9·946771 | 50 | 30 |
| 48 | 12 | 9·668746 | 6 24 | 10·331254 | 9·722009 | 6 30 | 10·277991 | 10·053262 | 6 7 | 9·946738 | 48 | 12 |
| 30 | 14 | 9·668866 | 7 28 | 10·331134 | 9·722162 | 7 36 | 10·277838 | 10·053296 | 7 8 | 9·946704 | 46 | 30 |
| 49 | 16 | 9·668986 | 8 32 | 10·331014 | 9·722315 | 8 41 | 10·277685 | 10·053329 | 8 9 | 9·946671 | 44 | 11 |
| 30 | 18 | 9·669105 | 9 36 | 10·330895 | 9·722468 | 9 46 | 10·277532 | 10·053362 | 9 10 | 9·946638 | 42 | 30 |
| 50 | 20 | 9·669225 | 10 40 | 10·330775 | 9·722621 | 10 51 | 10·277379 | 10·053396 | 10 11 | 9·946604 | 40 | 10 |
| 30 | 22 | 9·669345 | 11 44 | 10·330655 | 9·722774 | 11 56 | 10·277226 | 10·053429 | 11 12 | 9·946571 | 38 | 30 |
| 51 | 24 | 9·669464 | 12 48 | 10·330536 | 9·722927 | 12 61 | 10·277073 | 10·053462 | 12 13 | 9·946538 | 36 | 9 |
| 30 | 26 | 9·669584 | 13 52 | 10·330416 | 9·723080 | 13 66 | 10·276920 | 10·053496 | 13 14 | 9·946504 | 34 | 30 |
| 52 | 28 | 9·669703 | 14 56 | 10·330297 | 9·723232 | 14 71 | 10·276768 | 10·053529 | 14 16 | 9·946471 | 32 | 8 |
| 30 | 30 | 9·669823 | 15 60 | 10·330177 | 9·723385 | 15 76 | 10·276615 | 10·053563 | 15 17 | 9·946437 | 30 | 30 |
| 53 | 32 | 9·669942 | 16 64 | 10·330058 | 9·723538 | 16 81 | 10·276462 | 10·053596 | 16 18 | 9·946404 | 28 | 7 |
| 30 | 34 | 9·670061 | 17 68 | 10·329939 | 9·723691 | 17 87 | 10·276309 | 10·053629 | 17 19 | 9·946371 | 26 | 30 |
| 54 | 36 | 9·670181 | 18 72 | 10·329819 | 9·723844 | 18 92 | 10·276156 | 10·053663 | 18 20 | 9·946337 | 24 | 6 |
| 30 | 38 | 9·670300 | 19 76 | 10·329700 | 9·723996 | 19 97 | 10·276004 | 10·053696 | 19 21 | 9·946304 | 22 | 30 |
| 55 | 40 | 9·670419 | 20 80 | 10·329581 | 9·724149 | 20 102 | 10·275851 | 10·053730 | 20 22 | 9·946270 | 20 | 5 |
| 30 | 42 | 9·670538 | 21 84 | 10·329462 | 9·724302 | 21 107 | 10·275698 | 10·053763 | 21 23 | 9·946237 | 18 | 30 |
| 56 | 44 | 9·670658 | 22 88 | 10·329342 | 9·724454 | 22 112 | 10·275546 | 10·053797 | 22 24 | 9·946203 | 16 | 4 |
| 30 | 46 | 9·670777 | 23 92 | 10·329223 | 9·724607 | 23 117 | 10·275393 | 10·053830 | 23 26 | 9·946170 | 14 | 30 |
| 57 | 48 | 9·670896 | 24 96 | 10·329104 | 9·724760 | 24 122 | 10·275240 | 10·053864 | 24 27 | 9·946136 | 12 | 3 |
| 30 | 50 | 9·671015 | 25 100 | 10·328985 | 9·724912 | 25 127 | 10·275088 | 10·053897 | 25 28 | 9·946103 | 10 | 30 |
| 58 | 52 | 9·671134 | 26 104 | 10·328866 | 9·725065 | 26 132 | 10·274935 | 10·053931 | 26 29 | 9·946069 | 8 | 2 |
| 30 | 54 | 9·671253 | 27 107 | 10·328747 | 9·725217 | 27 137 | 10·274783 | 10·053964 | 27 30 | 9·946036 | 6 | 30 |
| 59 | 56 | 9·671372 | 28 111 | 10·328628 | 9·725370 | 28 143 | 10·274630 | 10·053998 | 28 31 | 9·946002 | 4 | 1 |
| 30 | 58 | 9·671490 | 29 115 | 10·328510 | 9·725522 | 29 148 | 10·274478 | 10·054031 | 29 32 | 9·945969 | 2 | 30 |
| 60 | 52 | 9·671609 | 30 119 | 10·328391 | 9·725674 | 30 153 | 10·274326 | 10·054065 | 30 33 | 9·945935 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

62° — 4h 8m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

1h 52m — 28°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·671609 | | 10·328391 | 9·725674 | | 10·274326 | 10·054065 | | 9·945935 | 8 | 60 |
| 30 | 2 | 9·671728 | 1″ 4 | 10·328272 | 9·725827 | 1″ 5 | 10·274173 | 10·054099 | 1″ 1 | 9·945901 | 58 | 30 |
| 1 | 4 | 9·671847 | 2 8 | 10·328153 | 9·725979 | 2 10 | 10·274021 | 10·054132 | 2 2 | 9·945868 | 56 | 59 |
| 30 | 6 | 9·671965 | 3 12 | 10·328035 | 9·726131 | 3 15 | 10·273869 | 10·054166 | 3 3 | 9·945834 | 54 | 30 |
| 2 | 8 | 9·672084 | 4 16 | 10·327916 | 9·726284 | 4 20 | 10·273716 | 10·054200 | 4 4 | 9·945800 | 52 | 58 |
| 30 | 10 | 9·672203 | 5 20 | 10·327797 | 9·726436 | 5 25 | 10·273564 | 10·054233 | 5 6 | 9·945767 | 50 | 30 |
| 3 | 12 | 9·672321 | 6 24 | 10·327679 | 9·726588 | 6 30 | 10·273412 | 10·054267 | 6 7 | 9·945733 | 48 | 57 |
| 30 | 14 | 9·672440 | 7 28 | 10·327560 | 9·726740 | 7 35 | 10·273260 | 10·054300 | 7 8 | 9·945700 | 46 | 30 |
| 4 | 16 | 9·672558 | 8 32 | 10·327442 | 9·726892 | 8 40 | 10·273108 | 10·054334 | 8 9 | 9·945666 | 44 | 56 |
| 30 | 18 | 9·672677 | 9 35 | 10·327323 | 9·727045 | 9 46 | 10·272955 | 10·054368 | 9 10 | 9·945632 | 42 | 30 |
| 5 | 20 | 9·672795 | 10 39 | 10·327205 | 9·727197 | 10 51 | 10·272803 | 10·054402 | 10 11 | 9·945598 | 40 | 55 |
| 30 | 22 | 9·672914 | 11 43 | 10·327086 | 9·727349 | 11 56 | 10·272651 | 10·054435 | 11 12 | 9·945565 | 38 | 30 |
| 6 | 24 | 9·673032 | 12 47 | 10·326968 | 9·727501 | 12 61 | 10·272499 | 10·054469 | 12 13 | 9·945531 | 36 | 54 |
| 30 | 26 | 9·673150 | 13 51 | 10·326850 | 9·727653 | 13 66 | 10·272347 | 10·054503 | 13 15 | 9·945497 | 34 | 30 |
| 7 | 28 | 9·673268 | 14 55 | 10·326732 | 9·727805 | 14 71 | 10·272195 | 10·054536 | 14 16 | 9·945464 | 32 | 53 |
| 30 | 30 | 9·673387 | 15 59 | 10·326613 | 9·727957 | 15 76 | 10·272043 | 10·054570 | 15 17 | 9·945430 | 30 | 30 |
| 8 | 32 | 9·673505 | 16 63 | 10·326495 | 9·728109 | 16 81 | 10·271891 | 10·054604 | 16 18 | 9·945396 | 28 | 52 |
| 30 | 34 | 9·673623 | 17 67 | 10·326377 | 9·728261 | 17 86 | 10·271739 | 10·054638 | 17 19 | 9·945362 | 26 | 30 |
| 9 | 36 | 9·673741 | 18 71 | 10·326259 | 9·728412 | 18 91 | 10·271588 | 10·054672 | 18 20 | 9·945328 | 24 | 51 |
| 30 | 38 | 9·673859 | 19 75 | 10·326141 | 9·728564 | 19 96 | 10·271436 | 10·054705 | 19 21 | 9·945295 | 22 | 30 |
| 10 | 40 | 9·673977 | 20 79 | 10·326023 | 9·728716 | 20 101 | 10·271284 | 10·054739 | 20 23 | 9·945261 | 20 | 50 |
| 30 | 42 | 9·674095 | 21 83 | 10·325905 | 9·728868 | 21 106 | 10·271132 | 10·054773 | 21 24 | 9·945227 | 18 | 30 |
| 11 | 44 | 9·674213 | 22 87 | 10·325787 | 9·729020 | 22 111 | 10·270980 | 10·054807 | 22 25 | 9·945193 | 16 | 49 |
| 30 | 46 | 9·674331 | 23 91 | 10·325669 | 9·729171 | 23 116 | 10·270829 | 10·054841 | 23 26 | 9·945159 | 14 | 30 |
| 12 | 48 | 9·674448 | 24 95 | 10·325552 | 9·729323 | 24 121 | 10·270677 | 10·054875 | 24 27 | 9·945125 | 12 | 48 |
| 30 | 50 | 9·674566 | 25 99 | 10·325434 | 9·729475 | 25 126 | 10·270525 | 10·054908 | 25 28 | 9·945092 | 10 | 30 |
| 13 | 52 | 9·674684 | 26 103 | 10·325316 | 9·729626 | 26 132 | 10·270374 | 10·054942 | 26 29 | 9·945058 | 8 | 47 |
| 30 | 54 | 9·674802 | 27 106 | 10·325198 | 9·729778 | 27 137 | 10·270222 | 10·054976 | 27 30 | 9·945024 | 6 | 30 |
| 14 | 56 | 9·674919 | 28 110 | 10·325081 | 9·729929 | 28 142 | 10·270071 | 10·055010 | 28 31 | 9·944990 | 4 | 46 |
| 30 | 58 | 9·675037 | 29 114 | 10·324963 | 9·730081 | 29 147 | 10·269919 | 10·055044 | 29 32 | 9·944956 | 2 | 30 |
| 15 | **53** | 9·675155 | 30 118 | 10·324845 | 9·730233 | 30 152 | 10·269767 | 10·055078 | 30 34 | 9·944922 | **7** | 45 |
| 30 | 2 | 9·675272 | 1 4 | 10·324728 | 9·730384 | 1 5 | 10·269616 | 10·055112 | 1 1 | 9·944888 | 58 | 30 |
| 16 | 4 | 9·675390 | 2 8 | 10·324610 | 9·730535 | 2 10 | 10·269465 | 10·055146 | 2 2 | 9·944854 | 56 | 44 |
| 30 | 6 | 9·675507 | 3 12 | 10·324493 | 9·730687 | 3 15 | 10·269313 | 10·055180 | 3 3 | 9·944820 | 54 | 30 |
| 17 | 8 | 9·675624 | 4 16 | 10·324376 | 9·730838 | 4 20 | 10·269162 | 10·055214 | 4 5 | 9·944786 | 52 | 43 |
| 30 | 10 | 9·675742 | 5 19 | 10·324258 | 9·730990 | 5 25 | 10·269010 | 10·055248 | 5 6 | 9·944752 | 50 | 30 |
| 18 | 12 | 9·675859 | 6 23 | 10·324141 | 9·731141 | 6 30 | 10·268859 | 10·055282 | 6 7 | 9·944718 | 48 | 42 |
| 30 | 14 | 9·675976 | 7 27 | 10·324024 | 9·731292 | 7 35 | 10·268708 | 10·055316 | 7 8 | 9·944684 | 46 | 30 |
| 19 | 16 | 9·676094 | 8 31 | 10·323906 | 9·731444 | 8 40 | 10·268556 | 10·055350 | 8 9 | 9·944650 | 44 | 41 |
| 30 | 18 | 9·676211 | 9 35 | 10·323789 | 9·731595 | 9 45 | 10·268405 | 10·055384 | 9 10 | 9·944616 | 42 | 30 |
| 20 | 20 | 9·676328 | 10 39 | 10·323672 | 9·731746 | 10 50 | 10·268254 | 10·055418 | 10 11 | 9·944582 | 40 | 40 |
| 30 | 22 | 9·676445 | 11 43 | 10·323555 | 9·731897 | 11 55 | 10·268103 | 10·055452 | 11 12 | 9·944548 | 38 | 30 |
| 21 | 24 | 9·676562 | 12 47 | 10·323438 | 9·732048 | 12 60 | 10·267952 | 10·055486 | 12 14 | 9·944514 | 36 | 39 |
| 30 | 26 | 9·676679 | 13 51 | 10·323321 | 9·732200 | 13 65 | 10·267800 | 10·055520 | 13 15 | 9·944480 | 34 | 30 |
| 22 | 28 | 9·676796 | 14 55 | 10·323204 | 9·732351 | 14 70 | 10·267649 | 10·055554 | 14 16 | 9·944446 | 32 | 38 |
| 30 | 30 | 9·676913 | 15 58 | 10·323087 | 9·732502 | 15 75 | 10·267498 | 10·055588 | 15 17 | 9·944412 | 30 | 30 |
| 23 | 32 | 9·677030 | 16 62 | 10·322970 | 9·732653 | 16 80 | 10·267347 | 10·055623 | 16 18 | 9·944377 | 28 | 37 |
| 30 | 34 | 9·677147 | 17 66 | 10·322853 | 9·732804 | 17 86 | 10·267196 | 10·055657 | 17 19 | 9·944343 | 26 | 30 |
| 24 | 36 | 9·677264 | 18 70 | 10·322736 | 9·732955 | 18 91 | 10·267045 | 10·055691 | 18 20 | 9·944309 | 24 | 36 |
| 30 | 38 | 9·677381 | 19 74 | 10·322619 | 9·733106 | 19 96 | 10·266894 | 10·055725 | 19 22 | 9·944275 | 22 | 30 |
| 25 | 40 | 9·677498 | 20 78 | 10·322502 | 9·733257 | 20 101 | 10·266743 | 10·055759 | 20 23 | 9·944241 | 20 | 35 |
| 30 | 42 | 9·677614 | 21 82 | 10·322386 | 9·733408 | 21 106 | 10·266592 | 10·055793 | 21 24 | 9·944207 | 18 | 30 |
| 26 | 44 | 9·677731 | 22 86 | 10·322269 | 9·733558 | 22 111 | 10·266442 | 10·055828 | 22 25 | 9·944172 | 16 | 34 |
| 30 | 46 | 9·677848 | 23 89 | 10·322152 | 9·733709 | 23 116 | 10·266291 | 10·055862 | 23 26 | 9·944138 | 14 | 30 |
| 27 | 48 | 9·677964 | 24 93 | 10·322036 | 9·733860 | 24 121 | 10·266140 | 10·055896 | 24 27 | 9·944104 | 12 | 33 |
| 30 | 50 | 9·678081 | 25 97 | 10·321919 | 9·734011 | 25 126 | 10·265989 | 10·055930 | 25 28 | 9·944070 | 10 | 30 |
| 28 | 52 | 9·678197 | 26 101 | 10·321803 | 9·734162 | 26 131 | 10·265838 | 10·055964 | 26 29 | 9·944036 | 8 | 32 |
| 30 | 54 | 9·678314 | 27 105 | 10·321686 | 9·734312 | 27 136 | 10·265688 | 10·055999 | 27 31 | 9·944001 | 6 | 30 |
| 29 | 56 | 9·678430 | 28 109 | 10·321570 | 9·734463 | 28 141 | 10·265537 | 10·056033 | 28 32 | 9·943967 | 4 | 31 |
| 30 | 58 | 9·678547 | 29 113 | 10·321453 | 9·734614 | 29 146 | 10·265386 | 10·056067 | 29 33 | 9·943933 | 2 | 30 |
| 30 | **54** | 9·678663 | 30 117 | 10·321337 | 9·734764 | 30 151 | 10·265236 | 10·056101 | 30 34 | 9·943899 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

61° — 4h 6m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

1h 54m — 28°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·678663 | | 10·321337 | 9·734764 | | 10·265236 | 10·056101 | | 9·943899 | **6** | 30 |
| 30 | 2 | 9·678779 | 1″ 4 | 10·321221 | 9·734915 | 1″ 5 | 10·265085 | 10·056136 | 1″ 1 | 9·943864 | 58 | 30 |
| 31 | 4 | 9·678895 | 2 8 | 10·321105 | 9·735066 | 2 10 | 10·264934 | 10·056170 | 2 2 | 9·943830 | 56 | 29 |
| 30 | 6 | 9·679012 | 3 12 | 10·320988 | 9·735216 | 3 15 | 10·264784 | 10·056204 | 3 3 | 9·943796 | 54 | 30 |
| 32 | 8 | 9·679128 | 4 15 | 10·320872 | 9·735367 | 4 20 | 10·264633 | 10·056239 | 4 5 | 9·943761 | 52 | 28 |
| 30 | 10 | 9·679244 | 5 19 | 10·320756 | 9·735517 | 5 25 | 10·264483 | 10·056273 | 5 6 | 9·943727 | 50 | 30 |
| 33 | 12 | 9·679360 | 6 23 | 10·320640 | 9·735668 | 6 30 | 10·264332 | 10·056307 | 6 7 | 9·943693 | 48 | 27 |
| 30 | 14 | 9·679476 | 7 27 | 10·320524 | 9·735818 | 7 35 | 10·264182 | 10·056342 | 7 8 | 9·943658 | 46 | 30 |
| 34 | 16 | 9·679592 | 8 31 | 10·320408 | 9·735969 | 8 40 | 10·264031 | 10·056376 | 8 9 | 9·943624 | 44 | 26 |
| 30 | 18 | 9·679708 | 9 35 | 10·320292 | 9·736119 | 9 45 | 10·263881 | 10·056411 | 9 10 | 9·943589 | 42 | 30 |
| 35 | 20 | 9·679824 | 10 39 | 10·320176 | 9·736269 | 10 50 | 10·263731 | 10·056445 | 10 11 | 9·943555 | 40 | 25 |
| 30 | 22 | 9·679940 | 11 42 | 10·320060 | 9·736420 | 11 55 | 10·263580 | 10·056479 | 11 13 | 9·943521 | 38 | 30 |
| 36 | 24 | 9·680056 | 12 46 | 10·319944 | 9·736570 | 12 60 | 10·263430 | 10·056514 | 12 14 | 9·943486 | 36 | 24 |
| 30 | 26 | 9·680172 | 13 50 | 10·319828 | 9·736720 | 13 65 | 10·263280 | 10·056548 | 13 15 | 9·943452 | 34 | 30 |
| 37 | 28 | 9·680288 | 14 54 | 10·319712 | 9·736870 | 14 70 | 10·263130 | 10·056583 | 14 16 | 9·943417 | 32 | 23 |
| 30 | 30 | 9·680403 | 15 58 | 10·319597 | 9·737021 | 15 75 | 10·262979 | 10·056617 | 15 17 | 9·943383 | 30 | 30 |
| 38 | 32 | 9·680519 | 16 62 | 10·319481 | 9·737171 | 16 80 | 10·262829 | 10·056652 | 16 18 | 9·943348 | 28 | 22 |
| 30 | 34 | 9·680635 | 17 66 | 10·319365 | 9·737321 | 17 85 | 10·262679 | 10·056686 | 17 20 | 9·943314 | 26 | 30 |
| 39 | 36 | 9·680750 | 18 69 | 10·319250 | 9·737471 | 18 90 | 10·262529 | 10·056721 | 18 21 | 9·943279 | 24 | 21 |
| 30 | 38 | 9·680866 | 19 73 | 10·319134 | 9·737621 | 19 95 | 10·262379 | 10·056755 | 19 22 | 9·943245 | 22 | 30 |
| 40 | 40 | 9·680982 | 20 77 | 10·319018 | 9·737771 | 20 100 | 10·262229 | 10·056790 | 20 23 | 9·943210 | 20 | 20 |
| 30 | 42 | 9·681097 | 21 81 | 10·318903 | 9·737921 | 21 105 | 10·262079 | 10·056824 | 21 24 | 9·943176 | 18 | 30 |
| 41 | 44 | 9·681213 | 22 85 | 10·318787 | 9·738071 | 22 110 | 10·261929 | 10·056859 | 22 25 | 9·943141 | 16 | 19 |
| 30 | 46 | 9·681328 | 23 89 | 10·318672 | 9·738221 | 23 115 | 10·261779 | 10·056893 | 23 26 | 9·943107 | 14 | 30 |
| 42 | 48 | 9·681443 | 24 93 | 10·318557 | 9·738371 | 24 120 | 10·261629 | 10·056928 | 24 28 | 9·943072 | 12 | 18 |
| 30 | 50 | 9·681559 | 25 97 | 10·318441 | 9·738521 | 25 125 | 10·261479 | 10·056963 | 25 29 | 9·943037 | 10 | 30 |
| 43 | 52 | 9·681674 | 26 100 | 10·318326 | 9·738671 | 26 130 | 10·261329 | 10·056997 | 26 30 | 9·943003 | 8 | 17 |
| 30 | 54 | 9·681789 | 27 104 | 10·318211 | 9·738821 | 27 135 | 10·261179 | 10·057032 | 27 31 | 9·942968 | 6 | 30 |
| 44 | 56 | 9·681905 | 28 108 | 10·318095 | 9·738971 | 28 140 | 10·261029 | 10·057066 | 28 32 | 9·942934 | 4 | 16 |
| 30 | 58 | 9·682020 | 29 112 | 10·317980 | 9·739121 | 29 145 | 10·260879 | 10·057101 | 29 33 | 9·942899 | 2 | 30 |
| 45 | **55** | 9·682135 | 30 116 | 10·317865 | 9·739271 | 30 150 | 10·260729 | 10·057136 | 30 34 | 9·942864 | **5** | 15 |
| 30 | 2 | 9·682250 | 1 4 | 10·317750 | 9·739420 | 1 5 | 10·260580 | 10·057170 | 1 1 | 9·942830 | 58 | 30 |
| 46 | 4 | 9·682365 | 2 8 | 10·317635 | 9·739570 | 2 10 | 10·260430 | 10·057205 | 2 2 | 9·942795 | 56 | 14 |
| 30 | 6 | 9·682480 | 3 11 | 10·317520 | 9·739720 | 3 15 | 10·260280 | 10·057240 | 3 3 | 9·942760 | 54 | 30 |
| 47 | 8 | 9·682595 | 4 15 | 10·317405 | 9·739870 | 4 20 | 10·260130 | 10·057274 | 4 5 | 9·942726 | 52 | 13 |
| 30 | 10 | 9·682710 | 5 19 | 10·317290 | 9·740019 | 5 25 | 10·259981 | 10·057309 | 5 6 | 9·942691 | 50 | 30 |
| 48 | 12 | 9·682825 | 6 23 | 10·317175 | 9·740169 | 6 30 | 10·259831 | 10·057344 | 6 7 | 9·942656 | 48 | 12 |
| 30 | 14 | 9·682940 | 7 27 | 10·317060 | 9·740319 | 7 35 | 10·259681 | 10·057379 | 7 8 | 9·942621 | 46 | 30 |
| 49 | 16 | 9·683055 | 8 31 | 10·316945 | 9·740468 | 8 40 | 10·259532 | 10·057413 | 8 9 | 9·942587 | 44 | 11 |
| 30 | 18 | 9·683170 | 9 34 | 10·316830 | 9·740618 | 9 45 | 10·259382 | 10·057448 | 9 10 | 9·942552 | 42 | 30 |
| 50 | 20 | 9·683284 | 10 38 | 10·316716 | 9·740767 | 10 50 | 10·259233 | 10·057483 | 10 11 | 9·942517 | 40 | 10 |
| 30 | 22 | 9·683399 | 11 42 | 10·316601 | 9·740917 | 11 55 | 10·259083 | 10·057518 | 11 13 | 9·942482 | 38 | 30 |
| 51 | 24 | 9·683514 | 12 46 | 10·316486 | 9·741066 | 12 60 | 10·258934 | 10·057552 | 12 14 | 9·942448 | 36 | 9 |
| 30 | 26 | 9·683628 | 13 50 | 10·316372 | 9·741216 | 13 65 | 10·258784 | 10·057587 | 13 15 | 9·942413 | 34 | 30 |
| 52 | 28 | 9·683743 | 14 54 | 10·316257 | 9·741365 | 14 70 | 10·258635 | 10·057622 | 14 16 | 9·942378 | 32 | 8 |
| 30 | 30 | 9·683858 | 15 57 | 10·316142 | 9·741514 | 15 75 | 10·258486 | 10·057657 | 15 17 | 9·942343 | 30 | 30 |
| 53 | 32 | 9·683972 | 16 61 | 10·316028 | 9·741664 | 16 80 | 10·258336 | 10·057692 | 16 19 | 9·942308 | 28 | 7 |
| 30 | 34 | 9·684087 | 17 65 | 10·315913 | 9·741813 | 17 85 | 10·258187 | 10·057727 | 17 20 | 9·942273 | 26 | 30 |
| 54 | 36 | 9·684201 | 18 69 | 10·315799 | 9·741962 | 18 90 | 10·258038 | 10·057761 | 18 21 | 9·942239 | 24 | 6 |
| 30 | 38 | 9·684315 | 19 73 | 10·315685 | 9·742112 | 19 95 | 10·257888 | 10·057796 | 19 22 | 9·942204 | 22 | 30 |
| 55 | 40 | 9·684430 | 20 76 | 10·315570 | 9·742261 | 20 100 | 10·257739 | 10·057831 | 20 23 | 9·942169 | 20 | 5 |
| 30 | 42 | 9·684544 | 21 80 | 10·315456 | 9·742410 | 21 105 | 10·257590 | 10·057866 | 21 24 | 9·942134 | 18 | 30 |
| 56 | 44 | 9·684658 | 22 84 | 10·315342 | 9·742559 | 22 110 | 10·257441 | 10·057901 | 22 26 | 9·942099 | 16 | 4 |
| 30 | 46 | 9·684773 | 23 88 | 10·315227 | 9·742709 | 23 115 | 10·257291 | 10·057936 | 23 27 | 9·942064 | 14 | 30 |
| 57 | 48 | 9·684887 | 24 92 | 10·315113 | 9·742858 | 24 120 | 10·257142 | 10·057971 | 24 28 | 9·942029 | 12 | 3 |
| 30 | 50 | 9·685001 | 25 96 | 10·314999 | 9·743007 | 25 124 | 10·256993 | 10·058006 | 25 29 | 9·941994 | 10 | 30 |
| 58 | 52 | 9·685115 | 26 100 | 10·314885 | 9·743156 | 26 129 | 10·256844 | 10·058041 | 26 30 | 9·941959 | 8 | 2 |
| 30 | 54 | 9·685229 | 27 103 | 10·314771 | 9·743305 | 27 134 | 10·256695 | 10·058076 | 27 31 | 9·941924 | 6 | 30 |
| 59 | 56 | 9·685343 | 28 107 | 10·314657 | 9·743454 | 28 139 | 10·256546 | 10·058111 | 28 32 | 9·941889 | 4 | 1 |
| 30 | 58 | 9·685457 | 29 111 | 10·314543 | 9·743603 | 29 144 | 10·256397 | 10·058146 | 29 34 | 9·941854 | 2 | 30 |
| 60 | **56** | 9·685571 | 30 115 | 10·314429 | 9·743752 | 30 149 | 10·256248 | 10·058181 | 30 35 | 9·941819 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

61° — 4h 4m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

1h 56m — 29°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·685571 | | 10·314429 | 9·743752 | | 10·256248 | 10·058181 | | 9·941819 | 4 | 60 |
| 30 | 2 | 9·685685 | 1″ 4 | 10·314315 | 9·743901 | 1″ 5 | 10·256099 | 10·058216 | 1″ 1 | 9·941784 | 58 | 30 |
| 1 | 4 | 9·685799 | 2 8 | 10·314201 | 9·744050 | 2 10 | 10·255950 | 10·058251 | 2 2 | 9·941749 | 56 | 59 |
| 30 | 6 | 9·685913 | 3 11 | 10·314087 | 9·744199 | 3 15 | 10 255801 | 10·058286 | 3 4 | 9·941714 | 54 | 30 |
| 2 | 8 | 9·686027 | 4 15 | 10·313973 | 9·744348 | 4 20 | 10·255652 | 10·058321 | 4 5 | 9·941679 | 52 | 58 |
| 30 | 10 | 9·686141 | 5 19 | 10·313859 | 9·744496 | 5 25 | 10·255504 | 10·058356 | 5 6 | 9·941644 | 50 | 30 |
| 3 | 12 | 9·686254 | 6 23 | 10·313746 | 9·744645 | 6 30 | 10·255355 | 10·058391 | 6 7 | 9·941609 | 48 | 57 |
| 30 | 14 | 9·686368 | 7 26 | 10·313632 | 9·744794 | 7 35 | 10·255206 | 10·058426 | 7 8 | 9·941574 | 46 | 30 |
| 4 | 16 | 9·686482 | 8 30 | 10·313518 | 9·744943 | 8 40 | 10·255057 | 10·058461 | 8 9 | 9·941539 | 44 | 56 |
| 30 | 18 | 9·686595 | 9 34 | 10·313405 | 9·745092 | 9 45 | 10·254908 | 10·058496 | 9 11 | 9·941504 | 42 | 30 |
| 5 | 20 | 9·686709 | 10 38 | 10·313291 | 9·745240 | 10 49 | 10·254760 | 10·058531 | 10 12 | 9·941469 | 40 | 55 |
| 30 | 22 | 9·686822 | 11 42 | 10·313178 | 9·745389 | 11 54 | 10·254611 | 10·058567 | 11 13 | 9·941433 | 38 | 80 |
| 6 | 24 | 9·686936 | 12 46 | 10·313064 | 9·745538 | 12 59 | 10·254462 | 10·058602 | 12 14 | 9·941398 | 36 | 54 |
| 30 | 26 | 9·687049 | 13 49 | 10·312951 | 9·745686 | 13 64 | 10·254314 | 10·058637 | 13 15 | 9·941363 | 34 | 30 |
| 7 | 28 | 9·687163 | 14 53 | 10·312837 | 9·745835 | 14 69 | 10·254165 | 10·058672 | 14 16 | 9·941328 | 32 | 53 |
| 30 | 30 | 9·687276 | 15 57 | 10·312724 | 9·745983 | 15 74 | 10·254017 | 10·058707 | 15 18 | 9·941293 | 30 | 30 |
| 8 | 32 | 9·687389 | 16 61 | 10·312611 | 9·746132 | 16 79 | 10·253868 | 10·058742 | 16 19 | 9·941258 | 28 | 52 |
| 30 | 34 | 9·687503 | 17 64 | 10·312497 | 9·746281 | 17 84 | 10·253719 | 10·058778 | 17 20 | 9·941222 | 26 | 30 |
| 9 | 36 | 9·687616 | 18 68 | 10·312384 | 9·746429 | 18 89 | 10·253571 | 10·058813 | 18 21 | 9·941187 | 24 | 51 |
| 30 | 38 | 9·687729 | 19 72 | 10·312271 | 9·746577 | 19 94 | 10·253423 | 10·058848 | 19 22 | 9·941152 | 22 | 30 |
| 10 | 40 | 9·687843 | 20 76 | 10·312157 | 9·746726 | 20 99 | 10·253274 | 10·058883 | 20 23 | 9·941117 | 20 | 50 |
| 30 | 42 | 9·687956 | 21 79 | 10·312044 | 9·746874 | 21 104 | 10·253126 | 10·058919 | 21 25 | 9·941081 | 18 | 30 |
| 11 | 44 | 9·688069 | 22 83 | 10·311931 | 9·747023 | 22 109 | 10·252977 | 10·058954 | 22 26 | 9·941046 | 16 | 49 |
| 30 | 46 | 9·688182 | 23 87 | 10·311818 | 9·747171 | 23 114 | 10·252829 | 10·058989 | 23 27 | 9·941011 | 14 | 30 |
| 12 | 48 | 9·688295 | 24 91 | 10·311705 | 9·747319 | 24 119 | 10·252681 | 10·059025 | 24 28 | 9·940975 | 12 | 48 |
| 3 | 50 | 9·688408 | 25 95 | 10·311592 | 9·747468 | 25 124 | 10·252532 | 10·059060 | 25 29 | 9·940940 | 10 | 30 |
| 13 | 52 | 9·688521 | 26 98 | 10·311479 | 9·747616 | 26 129 | 10·252384 | 10·059095 | 26 30 | 9·940905 | 8 | 47 |
| 30 | 54 | 9·688634 | 27 102 | 10·311366 | 9·747764 | 27 134 | 10·252236 | 10·059130 | 27 32 | 9·940870 | 6 | 30 |
| 14 | 56 | 9·688747 | 28 106 | 10·311253 | 9·747913 | 28 139 | 10·252087 | 10·059166 | 28 33 | 9·940834 | 4 | 46 |
| 30 | 58 | 9·688860 | 29 110 | 10·311140 | 9·748061 | 29 144 | 10·251939 | 10·059201 | 29 34 | 9·940799 | 2 | 30 |
| 15 | 57 | 9·688972 | 30 113 | 10·311028 | 9·748209 | 30 148 | 10·251791 | 10·059237 | 30 35 | 9·940763 | 3 | 45 |
| 30 | 2 | 9·689085 | 1 4 | 10·310915 | 9·748357 | 1 5 | 10·251643 | 10·059272 | 1 1 | 9·940728 | 58 | 30 |
| 16 | 4 | 9·689198 | 2 7 | 10·310802 | 9·748505 | 2 10 | 10·251495 | 10·059307 | 2 2 | 9·940693 | 56 | 44 |
| 30 | 6 | 9·689311 | 3 11 | 10·310689 | 9·748653 | 3 15 | 10·251347 | 10·059343 | 3 4 | 9·940657 | 54 | 30 |
| 17 | 8 | 9·689423 | 4 15 | 10·310577 | 9·748801 | 4 20 | 10·251199 | 10·059378 | 4 5 | 9·940622 | 52 | 43 |
| 30 | 10 | 9·689536 | 5 19 | 10·310464 | 9·748949 | 5 25 | 10·251051 | 10·059414 | 5 6 | 9·940586 | 50 | 30 |
| 18 | 12 | 9·689648 | 6 22 | 10·310352 | 9·749097 | 6 30 | 10·250903 | 10·059449 | 6 7 | 9·940551 | 48 | 42 |
| 30 | 14 | 9·689761 | 7 26 | 10·310239 | 9·749245 | 7 34 | 10·250755 | 10·059484 | 7 8 | 9·940516 | 46 | 30 |
| 19 | 16 | 9·689873 | 8 30 | 10·310127 | 9·749393 | 8 39 | 10·250607 | 10·059520 | 8 9 | 9·940480 | 44 | 41 |
| 30 | 18 | 9·689986 | 9 34 | 10·310014 | 9·749541 | 9 44 | 10·250459 | 10·059555 | 9 11 | 9·940445 | 42 | 30 |
| 20 | 20 | 9·690098 | 10 37 | 10·309902 | 9·749689 | 10 49 | 10·250311 | 10·059591 | 10 12 | 9·940409 | 40 | 40 |
| 30 | 22 | 9·690211 | 11 41 | 10·309789 | 9·749837 | 11 54 | 10·250163 | 10·059626 | 11 13 | 9·940374 | 38 | 30 |
| 21 | 24 | 9·690323 | 12 45 | 10·309677 | 9·749985 | 12 59 | 10·250015 | 10·059662 | 12 14 | 9·940338 | 36 | 39 |
| 30 | 26 | 9·690435 | 13 49 | 10·309565 | 9·750133 | 13 64 | 10·249867 | 10·059697 | 13 15 | 9·940303 | 34 | 30 |
| 22 | 28 | 9·690548 | 14 52 | 10·309452 | 9·750281 | 14 69 | 10·249719 | 10·059733 | 14 17 | 9·940267 | 32 | 38 |
| 30 | 30 | 9·690660 | 15 56 | 10·309340 | 9·750428 | 15 74 | 10·249572 | 10·059769 | 15 18 | 9·940231 | 30 | 30 |
| 23 | 32 | 9·690772 | 16 60 | 10·309228 | 9·750576 | 16 79 | 10·249424 | 10·059804 | 16 19 | 9·940196 | 28 | 37 |
| 30 | 34 | 9·690884 | 17 64 | 10·309116 | 9·750724 | 17 84 | 10·249276 | 10·059840 | 17 20 | 9·940160 | 26 | 30 |
| 24 | 36 | 9·690996 | 18 67 | 10·309004 | 9·750872 | 18 89 | 10·249128 | 10·059875 | 18 21 | 9·940125 | 24 | 36 |
| 30 | 38 | 9·691108 | 19 71 | 10·308892 | 9·751019 | 19 93 | 10·248981 | 10·059911 | 19 22 | 9·940089 | 22 | 30 |
| 25 | 40 | 9·691220 | 20 75 | 10·308780 | 9·751167 | 20 98 | 10·248833 | 10·059946 | 20 24 | 9·940054 | 20 | 35 |
| 30 | 42 | 9·691332 | 21 79 | 10·308668 | 9·751315 | 21 103 | 10·248685 | 10·059982 | 21 25 | 9·940018 | 18 | 30 |
| 26 | 44 | 9·691444 | 22 82 | 10·308556 | 9·751462 | 22 108 | 10·248538 | 10·060018 | 22 26 | 9·939982 | 16 | 34 |
| 30 | 46 | 9·691556 | 23 86 | 10·308444 | 9·751610 | 23 113 | 10·248390 | 10·060053 | 23 27 | 9·939947 | 14 | 30 |
| 27 | 48 | 9·691668 | 24 90 | 10·308332 | 9·751757 | 24 118 | 10·248243 | 10·060089 | 24 28 | 9·939911 | 12 | 33 |
| 30 | 50 | 9·691780 | 25 94 | 10·308220 | 9·751905 | 25 123 | 10·248095 | 10·060125 | 25 30 | 9·939875 | 10 | 30 |
| 28 | 52 | 9·691892 | 26 98 | 10·308108 | 9·752052 | 26 128 | 10·247948 | 10·060160 | 26 31 | 9·939840 | 8 | 32 |
| 30 | 54 | 9·692004 | 27 101 | 10·307996 | 9·752200 | 27 133 | 10·247800 | 10·060196 | 27 32 | 9·939804 | 6 | 30 |
| 29 | 56 | 9·692115 | 28 105 | 10·307885 | 9·752347 | 28 138 | 10·247653 | 10·060232 | 28 33 | 9·939768 | 4 | 31 |
| 30 | 58 | 9·692227 | 29 108 | 10·307773 | 9·752495 | 29 143 | 10·247505 | 10·060267 | 29 34 | 9·939733 | 2 | 30 |
| 30 | 58 | 9·692339 | 30 112 | 10·307661 | 9·752642 | 30 148 | 10·247358 | 10·060303 | 30 36 | 9·939697 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

60° — 4h 2m

TABLE XXVI.—(*continued*).

## LOG. SINES. COSINES. &c.

1h 58m — 29°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·692339 | | 10·307661 | 9·752642 | | 10·247358 | 10·060303 | | 9·939697 | 2 | 30 |
| 30 | 2 | 9·692450 | 1″ 4 | 10·307550 | 9·752789 | 1″ 5 | 10·247211 | 10·060339 | 1″ 1 | 9·939661 | 58 | 30 |
| 31 | 4 | 9·692562 | 2 7 | 10·307438 | 9·752937 | 2 10 | 10·247063 | 10·060375 | 2 2 | 9·939625 | 56 | 29 |
| 30 | 6 | 9·692674 | 3 11 | 10·307326 | 9·753084 | 3 15 | 10·246916 | 10·060410 | 3 4 | 9·939590 | 54 | 30 |
| 32 | 8 | 9·692785 | 4 15 | 10·307215 | 9·753231 | 4 20 | 10·246769 | 10·060446 | 4 5 | 9·939554 | 52 | 28 |
| 30 | 10 | 9·692897 | 5 18 | 10·307103 | 9·753379 | 5 25 | 10·246621 | 10·060482 | 5 6 | 9·939518 | 50 | 30 |
| 33 | 12 | 9·693008 | 6 22 | 10·306992 | 9·753526 | 6 29 | 10·246474 | 10·060518 | 6 7 | 9·939482 | 48 | 27 |
| 30 | 14 | 9·693119 | 7 26 | 10·306881 | 9·753673 | 7 34 | 10·246327 | 10·060554 | 7 8 | 9·939446 | 46 | 30 |
| 34 | 16 | 9·693231 | 8 30 | 10·306769 | 9·753820 | 8 39 | 10·246180 | 10·060590 | 8 10 | 9·939410 | 44 | 26 |
| 30 | 18 | 9·693342 | 9 33 | 10·306658 | 9·753967 | 9 44 | 10·246033 | 10·060625 | 9 11 | 9·939375 | 42 | 30 |
| 35 | 20 | 9·693453 | 10 37 | 10·306547 | 9·754115 | 10 49 | 10·245885 | 10·060661 | 10 12 | 9·939339 | 40 | 25 |
| 30 | 22 | 9·693565 | 11 41 | 10·306435 | 9·754262 | 11 54 | 10·245738 | 10·060697 | 11 13 | 9·939303 | 38 | 30 |
| 36 | 24 | 9·693676 | 12 44 | 10·306324 | 9·754409 | 12 59 | 10·245591 | 10·060733 | 12 14 | 9·939267 | 36 | 24 |
| 30 | 26 | 9·693787 | 13 48 | 10·306213 | 9·754556 | 13 64 | 10·245444 | 10·060769 | 13 15 | 9·939231 | 34 | 30 |
| 37 | 28 | 9·693898 | 14 52 | 10·306102 | 9·754703 | 14 69 | 10·245297 | 10·060805 | 14 17 | 9·939195 | 32 | 23 |
| 30 | 30 | 9·694009 | 15 56 | 10·305991 | 9·754850 | 15 73 | 10·245150 | 10·060841 | 15 18 | 9·939159 | 30 | 30 |
| 38 | 32 | 9·694120 | 16 59 | 10·305880 | 9·754997 | 16 78 | 10·245003 | 10·060877 | 16 19 | 9·939123 | 28 | 22 |
| 30 | 34 | 9·694231 | 17 63 | 10·305769 | 9·755144 | 17 83 | 10·244856 | 10·060913 | 17 20 | 9·939087 | 26 | 30 |
| 39 | 36 | 9·694342 | 18 67 | 10·305658 | 9·755291 | 18 88 | 10·244709 | 10·060948 | 18 22 | 9·939052 | 24 | 21 |
| 30 | 38 | 9·694453 | 19 70 | 10·305547 | 9·755438 | 19 93 | 10·244562 | 10·060984 | 19 23 | 9·939016 | 22 | 30 |
| 40 | 40 | 9·694564 | 20 74 | 10·305436 | 9·755585 | 20 98 | 10·244415 | 10·061020 | 20 24 | 9·938980 | 20 | 20 |
| 30 | 42 | 9·694675 | 21 78 | 10·305325 | 9·755731 | 21 103 | 10·244269 | 10·061056 | 21 25 | 9·938944 | 18 | 30 |
| 41 | 44 | 9·694786 | 22 81 | 10·305214 | 9·755878 | 22 108 | 10·244122 | 10·061092 | 22 26 | 9·938908 | 16 | 19 |
| 30 | 46 | 9·694897 | 23 85 | 10·305103 | 9·756025 | 23 113 | 10·243975 | 10·061128 | 23 28 | 9·938872 | 14 | 30 |
| 42 | 48 | 9·695007 | 24 89 | 10·304993 | 9·756172 | 24 118 | 10·243828 | 10·061164 | 24 29 | 9·938836 | 12 | 18 |
| 30 | 50 | 9·695118 | 25 93 | 10·304882 | 9·756319 | 25 122 | 10·243681 | 10·061200 | 25 30 | 9·938800 | 10 | 30 |
| 43 | 52 | 9·695229 | 26 97 | 10·304771 | 9·756465 | 26 127 | 10·243535 | 10·061237 | 26 31 | 9·938763 | 8 | 17 |
| 30 | 54 | 9·695339 | 27 100 | 10·304661 | 9·756612 | 27 132 | 10·243388 | 10·061273 | 27 32 | 9·938727 | 6 | 30 |
| 44 | 56 | 9·695450 | 28 104 | 10·304550 | 9·756759 | 28 137 | 10·243241 | 10·061309 | 28 34 | 9·938691 | 4 | 16 |
| 30 | 58 | 9·695561 | 29 107 | 10·304439 | 9·756905 | 29 142 | 10·243095 | 10·061345 | 29 35 | 9·938655 | 2 | 30 |
| 45 | **59** | 9·695671 | 30 111 | 10·304329 | 9·757052 | 30 147 | 10·242948 | 10·061381 | 30 36 | 9·938619 | **1** | 15 |
| 30 | 2 | 9·695782 | 1 4 | 10·304218 | 9·757199 | 1 5 | 10·242801 | 10·061417 | 1 1 | 9·938583 | 58 | 30 |
| 46 | 4 | 9·695892 | 2 7 | 10·304108 | 9·757345 | 2 10 | 10·242655 | 10·061453 | 2 2 | 9·938547 | 56 | 14 |
| 30 | 6 | 9·696003 | 3 11 | 10·303997 | 9·757492 | 3 15 | 10·242508 | 10·061489 | 3 4 | 9·938511 | 54 | 30 |
| 47 | 8 | 9·696113 | 4 15 | 10·303887 | 9·757638 | 4 19 | 10·242362 | 10·061525 | 4 5 | 9·938475 | 52 | 13 |
| 30 | 10 | 9·696223 | 5 18 | 10·303777 | 9·757785 | 5 24 | 10·242215 | 10·061561 | 5 6 | 9·938439 | 50 | 30 |
| 48 | 12 | 9·696334 | 6 22 | 10·303666 | 9·757931 | 6 29 | 10·242069 | 10·061598 | 6 7 | 9·938402 | 48 | 12 |
| 30 | 14 | 9·696444 | 7 26 | 10·303556 | 9·758078 | 7 34 | 10·241922 | 10·061634 | 7 8 | 9·938366 | 46 | 30 |
| 49 | 16 | 9·696554 | 8 29 | 10·303446 | 9·758224 | 8 39 | 10·241776 | 10·061670 | 8 10 | 9·938330 | 44 | 11 |
| 30 | 18 | 9·696664 | 9 33 | 10·303336 | 9·758371 | 9 44 | 10·241629 | 10·061706 | 9 11 | 9·938294 | 42 | 30 |
| 50 | 20 | 9·696775 | 10 37 | 10·303225 | 9·758517 | 10 49 | 10·241483 | 10·061742 | 10 12 | 9·938258 | 40 | 10 |
| 30 | 22 | 9·696885 | 11 40 | 10·303115 | 9·758663 | 11 54 | 10·241337 | 10·061779 | 11 13 | 9·938221 | 38 | 30 |
| 51 | 24 | 9·696995 | 12 44 | 10·303005 | 9·758810 | 12 58 | 10·241190 | 10·061815 | 12 14 | 9·938185 | 36 | 9 |
| 30 | 26 | 9·697105 | 13 48 | 10·302895 | 9·758956 | 13 63 | 10·241044 | 10·061851 | 13 16 | 9·938149 | 34 | 30 |
| 52 | 28 | 9·697215 | 14 51 | 10·302785 | 9·759102 | 14 68 | 10·240898 | 10·061887 | 14 17 | 9·938113 | 32 | 8 |
| 30 | 30 | 9·697325 | 15 55 | 10·302675 | 9·759248 | 15 73 | 10·240752 | 10·061924 | 15 18 | 9·938076 | 30 | 30 |
| 53 | 32 | 9·697435 | 16 59 | 10·302565 | 9·759395 | 16 78 | 10·240605 | 10·061960 | 16 19 | 9·938040 | 28 | 7 |
| 30 | 34 | 9·697545 | 17 62 | 10·302455 | 9·759541 | 17 83 | 10·240459 | 10·061996 | 17 20 | 9·938004 | 26 | 30 |
| 54 | 36 | 9·697654 | 18 66 | 10·302346 | 9·759687 | 18 88 | 10·240313 | 10·062033 | 18 22 | 9·937967 | 24 | 6 |
| 30 | 38 | 9·697764 | 19 70 | 10·302236 | 9·759833 | 19 93 | 10·240167 | 10·062069 | 19 23 | 9·937931 | 22 | 30 |
| 55 | 40 | 9·697874 | 20 73 | 10·302126 | 9·759979 | 20 97 | 10·240021 | 10·062105 | 20 24 | 9·937895 | 20 | 5 |
| 30 | 42 | 9·697984 | 21 77 | 10·302016 | 9·760126 | 21 102 | 10·239874 | 10·062142 | 21 25 | 9·937858 | 18 | 30 |
| 56 | 44 | 9·698094 | 22 81 | 10·301906 | 9·760272 | 22 107 | 10·239728 | 10·062178 | 22 26 | 9·937822 | 16 | 4 |
| 30 | 46 | 9·698203 | 23 84 | 10·301797 | 9·760418 | 23 112 | 10·239582 | 10·062214 | 23 28 | 9·937786 | 14 | 30 |
| 57 | 48 | 9·698313 | 24 88 | 10·301687 | 9·760564 | 24 117 | 10·239436 | 10·062251 | 24 29 | 9·937749 | 12 | 3 |
| 30 | 50 | 9·698423 | 25 92 | 10·301577 | 9·760710 | 25 122 | 10·239290 | 10·062287 | 25 30 | 9·937713 | 10 | 30 |
| 58 | 52 | 9·698532 | 26 95 | 10·301468 | 9·760856 | 26 127 | 10·239144 | 10·062324 | 26 31 | 9·937676 | 8 | 2 |
| 30 | 54 | 9·698642 | 27 99 | 10·301358 | 9·761002 | 27 131 | 10·238998 | 10·062360 | 27 32 | 9·937640 | 6 | 30 |
| 59 | 56 | 9·698751 | 28 103 | 10·301249 | 9·761148 | 28 136 | 10·238852 | 10·062396 | 28 34 | 9·937604 | 4 | 1 |
| 30 | 58 | 9·698861 | 29 106 | 10·301139 | 9·761293 | 29 141 | 10·238707 | 10·062433 | 29 35 | 9·937567 | 2 | 30 |
| 60 | **60** | 9·698970 | 30 110 | 10·301030 | 9·761439 | 30 146 | 10·238561 | 10·062469 | 30 36 | 9·937531 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

60° — 4h 0m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

2h 0m — 30°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·698970 | | 10·301030 | 9·761439 | | 10·238561 | 10·062469 | | 9·937531 | 60 | 60 |
| 30 | 2 | 9·699079 | 1″ 4 | 10·300921 | 9·761585 | 1″ 5 | 10·238415 | 10·062506 | 1″ 1 | 9·937494 | 58 | 30 |
| 1 | 4 | 9·699189 | 2 7 | 10·300811 | 9·761731 | 2 10 | 10·238269 | 10·062542 | 2 2 | 9·937458 | 56 | 59 |
| 30 | 6 | 9·699298 | 3 11 | 10·300702 | 9·761877 | 3 15 | 10·238123 | 10·062579 | 3 4 | 9·937421 | 54 | 30 |
| 2 | 8 | 9·699407 | 4 14 | 10·300593 | 9·762023 | 4 19 | 10·237977 | 10·062615 | 4 5 | 9·937385 | 52 | 58 |
| 30 | 10 | 9·699517 | 5 18 | 10·300483 | 9·762168 | 5 24 | 10·237832 | 10·062652 | 5 6 | 9·937348 | 50 | 30 |
| 3 | 12 | 9·699626 | 6 22 | 10·300374 | 9·762314 | 6 29 | 10·237686 | 10·062688 | 6 7 | 9·937312 | 48 | 57 |
| 30 | 14 | 9·699735 | 7 25 | 10·300265 | 9·762460 | 7 34 | 10·237540 | 10·062725 | 7 9 | 9·937275 | 46 | 30 |
| 4 | 16 | 9·699844 | 8 29 | 10·300156 | 9·762606 | 8 39 | 10·237394 | 10·062762 | 8 10 | 9·937238 | 44 | 56 |
| 30 | 18 | 9·699953 | 9 33 | 10·300047 | 9·762751 | 9 44 | 10·237249 | 10·062798 | 9 11 | 9·937202 | 42 | 30 |
| 5 | 20 | 9·700062 | 10 36 | 10·299938 | 9·762897 | 10 48 | 10·237103 | 10·062835 | 10 12 | 9·937165 | 40 | 55 |
| 30 | 22 | 9·700171 | 11 40 | 10·299829 | 9·763043 | 11 53 | 10·236957 | 10·062871 | 11 13 | 9·937129 | 38 | 30 |
| 6 | 24 | 9·700280 | 12 44 | 10·299720 | 9·763188 | 12 58 | 10·236812 | 10·062908 | 12 15 | 9·937092 | 36 | 54 |
| 30 | 26 | 9·700389 | 13 47 | 10·299611 | 9·763334 | 13 63 | 10·236666 | 10·062944 | 13 16 | 9·937056 | 34 | 30 |
| 7 | 28 | 9·700498 | 14 51 | 10·299502 | 9·763479 | 14 68 | 10·236521 | 10·062981 | 14 17 | 9·937019 | 32 | 53 |
| 30 | 30 | 9·700607 | 15 54 | 10·299393 | 9·763625 | 15 73 | 10·236375 | 10·063018 | 15 18 | 9·936982 | 30 | 30 |
| 8 | 32 | 9·700716 | 16 58 | 10·299284 | 9·763770 | 16 78 | 10·236230 | 10·063054 | 16 20 | 9·936946 | 28 | 52 |
| 30 | 34 | 9·700825 | 17 62 | 10·299175 | 9·763916 | 17 82 | 10·236084 | 10·063091 | 17 21 | 9·936909 | 26 | 30 |
| 9 | 36 | 9·700933 | 18 65 | 10·299067 | 9·764061 | 18 87 | 10·235939 | 10·063128 | 18 22 | 9·936872 | 24 | 51 |
| 30 | 38 | 9·701042 | 19 69 | 10·298958 | 9·764207 | 19 92 | 10·235793 | 10·063164 | 19 23 | 9·936836 | 22 | 30 |
| 10 | 40 | 9·701151 | 20 72 | 10·298849 | 9·764352 | 20 97 | 10·235648 | 10·063201 | 20 24 | 9·936799 | 20 | 50 |
| 30 | 42 | 9·701259 | 21 76 | 10·298741 | 9·764497 | 21 102 | 10·235503 | 10·063238 | 21 26 | 9·936762 | 18 | 30 |
| 11 | 44 | 9·701368 | 22 80 | 10·298632 | 9·764643 | 22 107 | 10·235357 | 10·063275 | 22 27 | 9·936725 | 16 | 49 |
| 30 | 46 | 9·701477 | 23 83 | 10·298523 | 9·764788 | 23 112 | 10·235212 | 10·063311 | 23 28 | 9·936689 | 14 | 30 |
| 12 | 48 | 9·701585 | 24 87 | 10·298415 | 9·764933 | 24 116 | 10·235067 | 10·063348 | 24 29 | 9·936652 | 12 | 48 |
| 30 | 50 | 9·701694 | 25 91 | 10·298306 | 9·765079 | 25 121 | 10·234921 | 10·063385 | 25 31 | 9·936615 | 10 | 30 |
| 13 | 52 | 9·701802 | 26 94 | 10·298198 | 9·765224 | 26 126 | 10·234776 | 10·063422 | 26 32 | 9·936578 | 8 | 47 |
| 30 | 54 | 9·701911 | 27 98 | 10·298089 | 9·765369 | 27 131 | 10·234631 | 10·063458 | 27 33 | 9·936542 | 6 | 30 |
| 14 | 56 | 9·702019 | 28 101 | 10·297981 | 9·765514 | 28 136 | 10·234486 | 10·063495 | 28 34 | 9·936505 | 4 | 46 |
| 30 | 58 | 9·702127 | 29 105 | 10·297873 | 9·765660 | 29 141 | 10·234340 | 10·063532 | 29 35 | 9·936468 | 2 | 30 |
| 15 | 1 | 9·702236 | 30 109 | 10·297764 | 9·765805 | 30 145 | 10·234195 | 10·063569 | 30 37 | 9·936431 | 59 | 45 |
| 30 | 2 | 9·702344 | 1 4 | 10·297656 | 9·765950 | 1 5 | 10·234050 | 10·063606 | 1 1 | 9·936394 | 58 | 30 |
| 16 | 4 | 9·702452 | 2 7 | 10·297548 | 9·766095 | 2 10 | 10·233905 | 10·063643 | 2 2 | 9·936357 | 56 | 44 |
| 30 | 6 | 9·702561 | 3 11 | 10·297439 | 9·766240 | 3 14 | 10·233760 | 10·063680 | 3 4 | 9·936320 | 54 | 30 |
| 17 | 8 | 9·702669 | 4 14 | 10·297331 | 9·766385 | 4 19 | 10·233615 | 10·063716 | 4 5 | 9·936284 | 52 | 43 |
| 30 | 10 | 9·702777 | 5 18 | 10·297223 | 9·766530 | 5 24 | 10·233470 | 10·063753 | 5 6 | 9·936247 | 50 | 30 |
| 18 | 12 | 9·702885 | 6 22 | 10·297115 | 9·766675 | 6 29 | 10·233325 | 10·063790 | 6 7 | 9·936210 | 48 | 42 |
| 30 | 14 | 9·702993 | 7 25 | 10·297007 | 9·766820 | 7 34 | 10·233180 | 10·063827 | 7 9 | 9·936173 | 46 | 30 |
| 19 | 16 | 9·703101 | 8 29 | 10·296899 | 9·766965 | 8 39 | 10·233035 | 10·063864 | 8 10 | 9·936136 | 44 | 41 |
| 30 | 18 | 9·703209 | 9 32 | 10·296791 | 9·767110 | 9 43 | 10·232890 | 10·063901 | 9 11 | 9·936099 | 42 | 30 |
| 20 | 20 | 9·703317 | 10 36 | 10·296683 | 9·767255 | 10 48 | 10·232745 | 10·063938 | 10 12 | 9·936062 | 40 | 40 |
| 30 | 22 | 9·703425 | 11 39 | 10·296575 | 9·767400 | 11 53 | 10·232600 | 10·063975 | 11 14 | 9·936025 | 38 | 30 |
| 21 | 24 | 9·703533 | 12 43 | 10·296467 | 9·767545 | 12 58 | 10·232455 | 10·064012 | 12 15 | 9·935988 | 36 | 39 |
| 30 | 26 | 9·703641 | 13 47 | 10·296359 | 9·767690 | 13 63 | 10·232310 | 10·064049 | 13 16 | 9·935951 | 34 | 30 |
| 22 | 28 | 9·703749 | 14 50 | 10·296251 | 9·767834 | 14 68 | 10·232166 | 10·064086 | 14 17 | 9·935914 | 32 | 38 |
| 30 | 30 | 9·703856 | 15 54 | 10·296144 | 9·767979 | 15 72 | 10·232021 | 10·064123 | 15 18 | 9·935877 | 30 | 30 |
| 23 | 32 | 9·703964 | 16 57 | 10·296036 | 9·768124 | 16 77 | 10·231876 | 10·064160 | 16 20 | 9·935840 | 28 | 37 |
| 30 | 34 | 9·704072 | 17 61 | 10·295028 | 9·768269 | 17 82 | 10·231731 | 10·064197 | 17 21 | 9·935803 | 26 | 30 |
| 24 | 36 | 9·704179 | 18 64 | 10·295821 | 9·768414 | 18 87 | 10·231586 | 10·064234 | 18 22 | 9·935766 | 24 | 36 |
| 30 | 38 | 9·704287 | 19 68 | 10·295713 | 9·768558 | 19 92 | 10·231442 | 10·064271 | 19 24 | 9·935729 | 22 | 30 |
| 25 | 40 | 9·704395 | 20 72 | 10·295605 | 9·768703 | 20 97 | 10·231297 | 10·064308 | 20 25 | 9·935692 | 20 | 35 |
| 30 | 42 | 9·704502 | 21 75 | 10·295498 | 9·768848 | 21 101 | 10·231152 | 10·064345 | 21 26 | 9·935655 | 18 | 30 |
| 26 | 44 | 9·704610 | 22 79 | 10·295390 | 9·768992 | 22 106 | 10·231008 | 10·064382 | 22 27 | 9·935618 | 16 | 34 |
| 30 | 46 | 9·704717 | 23 83 | 10·295283 | 9·769137 | 23 111 | 10·230863 | 10·064419 | 23 28 | 9·935581 | 14 | 30 |
| 27 | 48 | 9·704825 | 24 86 | 10·295175 | 9·769281 | 24 116 | 10·230719 | 10·064457 | 24 30 | 9·935543 | 12 | 33 |
| 30 | 50 | 9·704932 | 25 90 | 10·295068 | 9·769426 | 25 121 | 10·230574 | 10·064494 | 25 31 | 9·935506 | 10 | 30 |
| 28 | 52 | 9·705040 | 26 93 | 10·294960 | 9·769571 | 26 126 | 10·230429 | 10·064531 | 26 32 | 9·935469 | 8 | 32 |
| 30 | 54 | 9·705147 | 27 97 | 10·294853 | 9·769715 | 27 130 | 10·230285 | 10·064568 | 27 33 | 9·935432 | 6 | 30 |
| 29 | 56 | 9·705254 | 28 100 | 10·294746 | 9·769860 | 28 135 | 10·230140 | 10·064605 | 28 35 | 9·935395 | 4 | 31 |
| 30 | 58 | 9·705362 | 29 104 | 10·294638 | 9·770004 | 29 140 | 10·229996 | 10·064642 | 29 36 | 9·935358 | 2 | 30 |
| 30 | 2 | 9·705469 | 30 108 | 10·294531 | 9·770148 | 30 145 | 10·229852 | 10·064680 | 30 37 | 9·935320 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

59° — 3h 58m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$2^h\ 2^m$ 30°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·705469 | | 10·294531 | 9·770148 | | 10·229852 | 10·064680 | | 9·935320 | 58 | 30 |
| 30 | 2 | 9·705576 | 1″ 4 | 10·294424 | 9·770293 | 1″ 5 | 10·229707 | 10·064717 | 1″ 1 | 9·935283 | 58 | 30 |
| 31 | 4 | 9·705683 | 2 7 | 10·294317 | 9·770437 | 2 10 | 10·229563 | 10·064754 | 2 2 | 9·935246 | 56 | 29 |
| 30 | 6 | 9·705790 | 3 11 | 10·294210 | 9·770582 | 3 14 | 10·229418 | 10·064791 | 3 4 | 9·935209 | 54 | 30 |
| 32 | 8 | 9·705898 | 4 14 | 10·294102 | 9·770726 | 4 19 | 10·229274 | 10·064829 | 4 5 | 9·935171 | 52 | 28 |
| 30 | 10 | 9·706005 | 5 18 | 10·293995 | 9·770870 | 5 24 | 10·229130 | 10·064866 | 5 6 | 9·935134 | 50 | 30 |
| 33 | 12 | 9·706112 | 6 21 | 10·293888 | 9·771015 | 6 29 | 10·228985 | 10·064903 | 6 7 | 9·935097 | 48 | 27 |
| 30 | 14 | 9·706219 | 7 25 | 10·293781 | 9·771159 | 7 34 | 10·228841 | 10·064940 | 7 9 | 9·935060 | 46 | 30 |
| 34 | 16 | 9·706326 | 8 28 | 10·293674 | 9·771303 | 8 38 | 10·228697 | 10·064978 | 8 10 | 9·935022 | 44 | 26 |
| 30 | 18 | 9·706433 | 9 32 | 10·293567 | 9·771448 | 9 43 | 10·228552 | 10·065015 | 9 11 | 9·934985 | 42 | 30 |
| 35 | 20 | 9·706539 | 10 36 | 10·293461 | 9·771592 | 10 48 | 10·228408 | 10·065052 | 10 12 | 9·934948 | 40 | 25 |
| 30 | 22 | 9·706646 | 11 39 | 10·293354 | 9·771736 | 11 53 | 10·228264 | 10·065090 | 11 14 | 9·934910 | 38 | 30 |
| 36 | 24 | 9·706753 | 12 43 | 10·293247 | 9·771880 | 12 58 | 10·228120 | 10·065127 | 12 15 | 9·934873 | 36 | 24 |
| 30 | 26 | 9·706860 | 13 46 | 10·293140 | 9·772024 | 13 62 | 10·227976 | 10·065164 | 13 16 | 9·934836 | 34 | 30 |
| 37 | 28 | 9·706967 | 14 50 | 10·293033 | 9·772168 | 14 67 | 10·227832 | 10·065202 | 14 17 | 9·934798 | 32 | 23 |
| 30 | 30 | 9·707073 | 15 53 | 10·292927 | 9·772312 | 15 72 | 10·227688 | 10·065239 | 15 19 | 9·934761 | 30 | 30 |
| 38 | 32 | 9·707180 | 16 57 | 10·292820 | 9·772457 | 16 77 | 10·227543 | 10·065277 | 16 20 | 9·934723 | 28 | 22 |
| 30 | 34 | 9·707287 | 17 61 | 10·292713 | 9·772601 | 17 82 | 10·227399 | 10·065314 | 17 21 | 9·934686 | 26 | 30 |
| 39 | 36 | 9·707393 | 18 64 | 10·292607 | 9·772745 | 18 86 | 10·227255 | 10·065351 | 18 22 | 9·934649 | 24 | 21 |
| 30 | 38 | 9·707500 | 19 68 | 10·292500 | 9·772889 | 19 91 | 10·227111 | 10·065389 | 19 24 | 9·934611 | 22 | 30 |
| 40 | 40 | 9·707606 | 20 71 | 10·292394 | 9·773033 | 20 96 | 10·226967 | 10·065426 | 20 25 | 9·934574 | 20 | 20 |
| 30 | 42 | 9·707713 | 21 75 | 10·292287 | 9·773177 | 21 101 | 10·226823 | 10·065464 | 21 26 | 9·934536 | 18 | 30 |
| 41 | 44 | 9·707819 | 22 78 | 10·292181 | 9·773321 | 22 106 | 10·226679 | 10·065501 | 22 27 | 9·934499 | 16 | 19 |
| 30 | 46 | 9·707926 | 23 82 | 10·292074 | 9·773465 | 23 110 | 10·226535 | 10·065539 | 23 29 | 9·934461 | 14 | 30 |
| 42 | 48 | 9·708032 | 24 85 | 10·291968 | 9·773608 | 24 115 | 10·226392 | 10·065576 | 24 30 | 9·934424 | 12 | 18 |
| 30 | 50 | 9·708139 | 25 89 | 10·291861 | 9·773752 | 25 120 | 10·226248 | 10·065614 | 25 31 | 9·934386 | 10 | 30 |
| 43 | 52 | 9·708245 | 26 92 | 10·291755 | 9·773896 | 26 125 | 10·226104 | 10·065651 | 26 32 | 9·934349 | 8 | 17 |
| 30 | 54 | 9·708351 | 27 96 | 10·291649 | 9·774040 | 27 130 | 10·225960 | 10·065689 | 27 34 | 9·934311 | 6 | 30 |
| 44 | 56 | 9·708458 | 28 99 | 10·291542 | 9·774184 | 28 134 | 10·225816 | 10·065726 | 28 35 | 9·934274 | 4 | 16 |
| 30 | 58 | 9·708564 | 29 103 | 10·291436 | 9·774328 | 29 139 | 10·225672 | 10·065764 | 29 36 | 9·934236 | 2 | 30 |
| 45 | 3 | 9·708670 | 30 107 | 10·291330 | 9·774471 | 30 144 | 10·225529 | 10·065801 | 30 37 | 9·934199 | 57 | 15 |
| 30 | 2 | 9·708776 | 1 4 | 10·291224 | 9·774615 | 1 5 | 10·225385 | 10·065839 | 1 1 | 9·934161 | 58 | 30 |
| 46 | 4 | 9·708882 | 2 7 | 10·291118 | 9·774759 | 2 10 | 10·225241 | 10·065877 | 2 3 | 9·934123 | 56 | 14 |
| 30 | 6 | 9·708988 | 3 11 | 10·291012 | 9·774902 | 3 14 | 10·225098 | 10·065914 | 3 4 | 9·934086 | 54 | 30 |
| 47 | 8 | 9·709094 | 4 14 | 10·290906 | 9·775046 | 4 19 | 10·224954 | 10·065952 | 4 5 | 9·934048 | 52 | 13 |
| 30 | 10 | 9·709200 | 5 18 | 10·290800 | 9·775190 | 5 24 | 10·224810 | 10·065989 | 5 6 | 9·934011 | 50 | 30 |
| 48 | 12 | 9·709306 | 6 21 | 10·290694 | 9·775333 | 6 29 | 10·224667 | 10·066027 | 6 8 | 9·933973 | 48 | 12 |
| 30 | 14 | 9·709412 | 7 25 | 10·290588 | 9·775477 | 7 33 | 10·224523 | 10·066065 | 7 9 | 9·933935 | 46 | 30 |
| 49 | 16 | 9·709518 | 8 28 | 10·290482 | 9·775621 | 8 38 | 10·224379 | 10·066102 | 8 10 | 9·933898 | 44 | 11 |
| 30 | 18 | 9·709624 | 9 32 | 10·290376 | 9·775764 | 9 43 | 10·224236 | 10·066140 | 9 11 | 9·933860 | 42 | 30 |
| 50 | 20 | 9·709730 | 10 35 | 10·290270 | 9·775908 | 10 48 | 10·224092 | 10·066178 | 10 13 | 9·933822 | 40 | 10 |
| 30 | 22 | 9·709836 | 11 39 | 10·290164 | 9·776051 | 11 53 | 10·223949 | 10·066216 | 11 14 | 9·933784 | 38 | 30 |
| 51 | 24 | 9·709941 | 12 42 | 10·290059 | 9·776195 | 12 57 | 10·223805 | 10·066253 | 12 15 | 9·933747 | 30 | 9 |
| 30 | 26 | 9·710047 | 13 46 | 10·289953 | 9·776338 | 13 62 | 10·223662 | 10·066291 | 13 16 | 9·933709 | 34 | 30 |
| 52 | 28 | 9·710153 | 14 49 | 10·289847 | 9·776482 | 14 67 | 10·223518 | 10·066329 | 14 18 | 9·933671 | 32 | 8 |
| 30 | 30 | 9·710259 | 15 53 | 10·289741 | 9·776625 | 15 72 | 10·223375 | 10·066367 | 15 19 | 9·933633 | 30 | 30 |
| 53 | 32 | 9·710364 | 16 56 | 10·289636 | 9·776768 | 16 76 | 10·223232 | 10·066404 | 16 20 | 9·933596 | 28 | 7 |
| 30 | 34 | 9·710470 | 17 60 | 10·289530 | 9·776912 | 17 81 | 10·223088 | 10·066442 | 17 21 | 9·933558 | 26 | 30 |
| 54 | 36 | 9·710575 | 18 63 | 10·289425 | 9·777055 | 18 86 | 10·222945 | 10·066480 | 18 23 | 9·933520 | 24 | 6 |
| 30 | 38 | 9·710681 | 19 67 | 10·289319 | 9·777199 | 19 91 | 10·222801 | 10·066518 | 19 24 | 9·933482 | 22 | 30 |
| 55 | 40 | 9·710786 | 20 70 | 10·289214 | 9·777342 | 20 96 | 10·222658 | 10·066555 | 20 25 | 9·933445 | 20 | 5 |
| 30 | 42 | 9·710892 | 21 74 | 10·289108 | 9·777485 | 21 100 | 10·222515 | 10·066593 | 21 26 | 9·933407 | 18 | 30 |
| 56 | 44 | 9·710997 | 22 77 | 10·289003 | 9·777628 | 22 105 | 10·222372 | 10·066631 | 22 28 | 9·933369 | 16 | 4 |
| 30 | 46 | 9·711103 | 23 81 | 10·288897 | 9·777772 | 23 110 | 10·222228 | 10·066669 | 23 29 | 9·933331 | 14 | 30 |
| 57 | 48 | 9·711208 | 24 85 | 10·288792 | 9·777915 | 24 115 | 10·222085 | 10·066707 | 24 30 | 9·933293 | 12 | 3 |
| 30 | 50 | 9·711313 | 25 88 | 10·288687 | 9·778058 | 25 119 | 10·221942 | 10·066745 | 25 32 | 9·933255 | 10 | 30 |
| 58 | 52 | 9·711419 | 26 92 | 10·288581 | 9·778201 | 26 124 | 10·221799 | 10·066783 | 26 33 | 9·933217 | 8 | 2 |
| 30 | 54 | 9·711524 | 27 95 | 10·288476 | 9·778344 | 27 129 | 10·221656 | 10·066821 | 27 34 | 9·933179 | 6 | 30 |
| 59 | 56 | 9·711629 | 28 99 | 10·288371 | 9·778488 | 28 134 | 10·221512 | 10·066859 | 28 35 | 9·933141 | 4 | 1 |
| 30 | 58 | 9·711734 | 29 102 | 10·288266 | 9·778631 | 29 139 | 10·221369 | 10·066896 | 29 37 | 9·933104 | 2 | 30 |
| 60 | 4 | 9·711839 | 30 106 | 10·288161 | 9·778774 | 30 143 | 10·221226 | 10·066934 | 30 38 | 9·933066 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

59° $3^h\ 56^m$

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

2ʰ 4ᵐ — 31°

| ′ ″ ° | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·711839 | | 10·288161 | 9·778774 | | 10·221226 | 10·066934 | | 9·933066 | **56** | 60 |
| 30 | 2 | 9·711944 | 1″ 3 | 10·288056 | 9·778917 | 1″ 5 | 10·221083 | 10·066972 | 1″ 1 | 9·933028 | 58 | 30 |
| 1 | 4 | 9·712050 | 2 7 | 10·287950 | 9·779060 | 2 10 | 10·220940 | 10·067010 | 2 3 | 9·932990 | 56 | 59 |
| 30 | 6 | 9·712155 | 3 10 | 10·287845 | 9·779203 | 3 14 | 10·220797 | 10·067048 | 3 4 | 9·932952 | 54 | 30 |
| 2 | 8 | 9·712260 | 4 14 | 10·287740 | 9·779346 | 4 19 | 10·220654 | 10·067086 | 4 5 | 9·932914 | 52 | 58 |
| 30 | 10 | 9·712365 | 5 17 | 10·287635 | 9·779489 | 5 24 | 10·220511 | 10·067124 | 5 6 | 9·932876 | 50 | 30 |
| 3 | 12 | 9·712469 | 6 21 | 10·287531 | 9·779632 | 6 29 | 10·220368 | 10·067162 | 6 8 | 9·932838 | 48 | 57 |
| 30 | 14 | 9·712574 | 7 24 | 10·287426 | 9·779775 | 7 33 | 10·220225 | 10·067200 | 7 9 | 9·932800 | 46 | 30 |
| 4 | 16 | 9·712679 | 8 28 | 10·287321 | 9·779918 | 8 38 | 10·220082 | 10·067238 | 8 10 | 9·932762 | 44 | 56 |
| 30 | 18 | 9·712784 | 9 31 | 10·287216 | 9·780061 | 9 43 | 10·219939 | 10·067276 | 9 11 | 9·932724 | 42 | 30 |
| 5 | 20 | 9·712889 | 10 35 | 10·287111 | 9·780203 | 10 48 | 10·219797 | 10·067315 | 10 13 | 9·932685 | 40 | 55 |
| 30 | 22 | 9·712994 | 11 38 | 10·287006 | 9·780346 | 11 52 | 10·219654 | 10·067353 | 11 14 | 9·932647 | 38 | 30 |
| 6 | 24 | 9·713098 | 12 42 | 10·286902 | 9·780489 | 12 57 | 10·219511 | 10·067391 | 12 15 | 9·932609 | 36 | 54 |
| 30 | 26 | 9·713203 | 13 45 | 10·286797 | 9·780632 | 13 62 | 10·219368 | 10·067429 | 13 17 | 9·932571 | 34 | 30 |
| 7 | 28 | 9·713308 | 14 49 | 10·286692 | 9·780775 | 14 67 | 10·219225 | 10·067467 | 14 18 | 9·932533 | 32 | 53 |
| 30 | 30 | 9·713412 | 15 52 | 10·286588 | 9·780917 | 15 71 | 10·219083 | 10·067505 | 15 19 | 9·932495 | 30 | 30 |
| 8 | 32 | 9·713517 | 16 56 | 10·286483 | 9·781060 | 16 76 | 10·218940 | 10·067543 | 16 20 | 9·932457 | 28 | 52 |
| 30 | 34 | 9·713621 | 17 59 | 10·286379 | 9·781203 | 17 81 | 10·218797 | 10·067581 | 17 22 | 9·932419 | 26 | 30 |
| 9 | 36 | 9·713726 | 18 63 | 10·286274 | 9·781346 | 18 86 | 10·218654 | 10·067620 | 18 23 | 9·932380 | 24 | 51 |
| 30 | 38 | 9·713831 | 19 66 | 10·286169 | 9·781488 | 19 90 | 10·218512 | 10·067658 | 19 24 | 9·932342 | 22 | 30 |
| 10 | 40 | 9·713935 | 20 70 | 10·286065 | 9·781631 | 20 95 | 10·218369 | 10·067696 | 20 25 | 9·932304 | 20 | 50 |
| 30 | 42 | 9·714039 | 21 73 | 10·285961 | 9·781774 | 21 100 | 10·218226 | 10·067734 | 21 27 | 9·932266 | 18 | 30 |
| 11 | 44 | 9·714144 | 22 77 | 10·285856 | 9·781916 | 22 105 | 10·218084 | 10·067772 | 22 28 | 9·932228 | 16 | 49 |
| 30 | 46 | 9·714248 | 23 80 | 10·285752 | 9·782059 | 23 109 | 10·217941 | 10·067811 | 23 29 | 9·932189 | 14 | 30 |
| 12 | 48 | 9·714352 | 24 84 | 10·285648 | 9·782201 | 24 114 | 10·217799 | 10·067849 | 24 30 | 9·932151 | 12 | 48 |
| 30 | 50 | 9·714457 | 25 87 | 10·285543 | 9·782344 | 25 119 | 10·217656 | 10·067887 | 25 32 | 9·932113 | 10 | 30 |
| 13 | 52 | 9·714561 | 26 91 | 10·285439 | 9·782486 | 26 124 | 10·217514 | 10·067925 | 26 33 | 9·932075 | 8 | 47 |
| 30 | 54 | 9·714665 | 27 94 | 10·285335 | 9·782629 | 27 129 | 10·217371 | 10·067964 | 27 34 | 9·932036 | 6 | 30 |
| 14 | 56 | 9·714769 | 28 98 | 10·285231 | 9·782771 | 28 133 | 10·217229 | 10·068002 | 28 36 | 9·931998 | 4 | 46 |
| 30 | 58 | 9·714873 | 29 101 | 10·285127 | 9·782914 | 29 138 | 10·217086 | 10·068040 | 29 37 | 9·931960 | 2 | 30 |
| 15 | 5 | 9·714978 | 30 105 | 10·285022 | 9·783056 | 30 143 | 10·216944 | 10·068079 | 30 38 | 9·931921 | **55** | 45 |
| 30 | 2 | 9·715082 | 1 3 | 10·284918 | 9·783199 | 1 5 | 10·216801 | 10·068117 | 1 1 | 9·931883 | 58 | 30 |
| 16 | 4 | 9·715186 | 2 7 | 10·284814 | 9·783341 | 2 9 | 10·216659 | 10·068155 | 2 3 | 9·931845 | 56 | 44 |
| 30 | 6 | 9·715290 | 3 10 | 10·284710 | 9·783483 | 3 14 | 10·216517 | 10·068194 | 3 4 | 9·931806 | 54 | 30 |
| 17 | 8 | 9·715394 | 4 14 | 10·284606 | 9·783626 | 4 19 | 10·216374 | 10·068232 | 4 5 | 9·931768 | 52 | 43 |
| 30 | 10 | 9·715498 | 5 17 | 10·284502 | 9·783768 | 5 24 | 10·216232 | 10·068270 | 5 6 | 9·931730 | 50 | 30 |
| 18 | 12 | 9·715602 | 6 21 | 10·284398 | 9·783910 | 6 28 | 10·216090 | 10·068309 | 6 8 | 9·931691 | 43 | 42 |
| 30 | 14 | 9·715705 | 7 24 | 10·284295 | 9·784053 | 7 33 | 10·215947 | 10·068347 | 7 9 | 9·931653 | 46 | 30 |
| 19 | 16 | 9·715809 | 8 28 | 10·284191 | 9·784195 | 8 38 | 10·215805 | 10·068386 | 8 10 | 9·931614 | 44 | 41 |
| 30 | 18 | 9·715913 | 9 31 | 10·284087 | 9·784337 | 9 43 | 10·215663 | 10·068424 | 9 12 | 9·931576 | 42 | 30 |
| 20 | 20 | 9·716017 | 10 35 | 10·283983 | 9·784479 | 10 47 | 10·215521 | 10·068463 | 10 13 | 9·931537 | 40 | 40 |
| 30 | 22 | 9·716121 | 11 38 | 10·283879 | 9·784622 | 11 52 | 10·215378 | 10·068501 | 11 14 | 9·931499 | 38 | 30 |
| 21 | 24 | 9·716224 | 12 42 | 10·283776 | 9·784764 | 12 57 | 10·215236 | 10·068540 | 12 15 | 9·931460 | 36 | 39 |
| 30 | 26 | 9·716328 | 13 45 | 10·283672 | 9·784906 | 13 62 | 10·215094 | 10·068578 | 13 17 | 9·931422 | 34 | 30 |
| 22 | 28 | 9·716432 | 14 49 | 10·283568 | 9·785048 | 14 66 | 10·214952 | 10·068617 | 14 18 | 9·931383 | 32 | 38 |
| 30 | 30 | 9·716535 | 15 52 | 10·283465 | 9·785190 | 15 71 | 10·214810 | 10·068655 | 15 19 | 9·931345 | 30 | 30 |
| 23 | 32 | 9·716639 | 16 56 | 10·283361 | 9·785332 | 16 76 | 10·214668 | 10·068694 | 16 21 | 9·931306 | 28 | 37 |
| 30 | 34 | 9·716742 | 17 59 | 10·283258 | 9·785474 | 17 81 | 10·214526 | 10·068732 | 17 22 | 9·931268 | 26 | 30 |
| 24 | 36 | 9·716846 | 18 63 | 10·283154 | 9·785616 | 18 85 | 10·214384 | 10·068771 | 18 23 | 9·931229 | 24 | 36 |
| 30 | 38 | 9·716949 | 19 66 | 10·283051 | 9·785758 | 19 90 | 10·214242 | 10·068809 | 19 24 | 9·931191 | 22 | 30 |
| 25 | 40 | 9·717053 | 20 69 | 10·282947 | 9·785900 | 20 95 | 10·214100 | 10·068848 | 20 26 | 9·931152 | 20 | 35 |
| 30 | 42 | 9·717156 | 21 72 | 10·282844 | 9·786042 | 21 100 | 10·213958 | 10·068886 | 21 27 | 9·931114 | 18 | 30 |
| 26 | 44 | 9·717259 | 22 76 | 10·282741 | 9·786184 | 22 104 | 10·213816 | 10·068925 | 22 28 | 9·931075 | 16 | 34 |
| 30 | 46 | 9·717363 | 23 79 | 10·282637 | 9·786326 | 23 109 | 10·213674 | 10·068964 | 23 30 | 9·931036 | 14 | 30 |
| 27 | 48 | 9·717466 | 24 83 | 10·282534 | 9·786468 | 24 114 | 10·213532 | 10·069002 | 24 31 | 9·930998 | 12 | 33 |
| 30 | 50 | 9·717569 | 25 86 | 10·282431 | 9·786610 | 25 118 | 10·213390 | 10·069041 | 25 32 | 9·930959 | 10 | 30 |
| 28 | 52 | 9·717673 | 26 90 | 10·282327 | 9·786752 | 26 123 | 10·213248 | 10·069079 | 26 33 | 9·930921 | 8 | 32 |
| 30 | 54 | 9·717776 | 27 93 | 10·282224 | 9·786894 | 27 128 | 10·213106 | 10·069118 | 27 35 | 9·930882 | 6 | 30 |
| 29 | 56 | 9·717879 | 28 97 | 10·282121 | 9·787036 | 28 133 | 10·212964 | 10·069157 | 28 36 | 9·930843 | 4 | 31 |
| 30 | 58 | 9·717982 | 29 100 | 10·282018 | 9·787178 | 29 137 | 10·212822 | 10·069196 | 29 37 | 9·930804 | 2 | 30 |
| 30 | 6 | 9·718085 | 30 104 | 10·281915 | 9·787319 | 30 142 | 10·212681 | 10·069234 | 30 39 | 9·930766 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

58° — 3ʰ 54ᵐ

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

2h 6m — 31°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·718085 | | 10·281915 | 9·787319 | | 10·212681 | 10·069234 | | 9·930766 | 54 | 30 |
| 30 | 2 | 9·718188 | 1″ 3 | 10·281812 | 9·787461 | 1″ 5 | 10·212539 | 10·069273 | 1″ 1 | 9·930727 | 58 | 30 |
| 31 | 4 | 9·718291 | 2 7 | 10·281709 | 9·787603 | 2 9 | 10·212397 | 10·069312 | 2 3 | 9·930688 | 56 | 29 |
| 30 | 6 | 9·718394 | 3 10 | 10·281606 | 9·787745 | 3 14 | 10·212255 | 10·069350 | 3 4 | 9·930650 | 54 | 30 |
| 32 | 8 | 9·718497 | 4 14 | 10·281503 | 9·787886 | 4 19 | 10·212114 | 10·069389 | 4 5 | 9·930611 | 52 | 28 |
| 30 | 10 | 9·718600 | 5 17 | 10·281400 | 9·788028 | 5 24 | 10·211972 | 10·069428 | 5 6 | 9·930572 | 50 | 30 |
| 33 | 12 | 9·718703 | 6 20 | 10·281297 | 9·788170 | 6 28 | 10·211830 | 10·069467 | 6 8 | 9·930533 | 48 | 27 |
| 30 | 14 | 9·718806 | 7 24 | 10·281194 | 9·788311 | 7 33 | 10·211689 | 10·069506 | 7 9 | 9·930495 | 46 | 30 |
| 34 | 16 | 9·718909 | 8 27 | 10·281091 | 9·788453 | 8 38 | 10·211547 | 10·069544 | 8 10 | 9·930456 | 44 | 26 |
| 30 | 18 | 9·719011 | 9 31 | 10·280989 | 9·788595 | 9 42 | 10·211405 | 10·069583 | 9 12 | 9·930417 | 42 | 30 |
| 35 | 20 | 9·719114 | 10 34 | 10·280886 | 9·788736 | 10 47 | 10·211264 | 10·069622 | 10 13 | 9·930378 | 40 | 25 |
| 30 | 22 | 9·719217 | 11 38 | 10·280783 | 9·788878 | 11 52 | 10·211122 | 10·069661 | 11 14 | 9·930339 | 38 | 30 |
| 36 | 24 | 9·719320 | 12 41 | 10·280680 | 9·789019 | 12 57 | 10·210981 | 10·069700 | 12 16 | 9·930300 | 36 | 24 |
| 30 | 26 | 9·719422 | 13 44 | 10·280578 | 9·789161 | 13 61 | 10·210839 | 10·069739 | 13 17 | 9·930262 | 34 | 30 |
| 37 | 28 | 9·719525 | 14 48 | 10·280475 | 9·789302 | 14 66 | 10·210698 | 10·069777 | 14 18 | 9·930223 | 32 | 23 |
| 30 | 30 | 9·719627 | 15 51 | 10·280372 | 9·789444 | 15 71 | 10·210556 | 10·069816 | 15 20 | 9·930184 | 30 | 30 |
| 38 | 32 | 9·719730 | 16 55 | 10·280270 | 9·789585 | 16 75 | 10·210415 | 10·069855 | 16 21 | 9·930145 | 28 | 22 |
| 30 | 34 | 9·719833 | 17 58 | 10·280167 | 9·789727 | 17 80 | 10·210273 | 10·069894 | 17 22 | 9·930106 | 26 | 30 |
| 39 | 36 | 9·719935 | 18 62 | 10·280065 | 9·789868 | 18 85 | 10·210132 | 10·069933 | 18 23 | 9·930067 | 24 | 21 |
| 30 | 38 | 9·720038 | 19 65 | 10·279962 | 9·790009 | 19 89 | 10·209991 | 10·069972 | 19 25 | 9·930028 | 22 | 30 |
| 40 | 40 | 9·720140 | 20 68 | 10·279860 | 9·790151 | 20 94 | 10·209849 | 10·070011 | 20 26 | 9·929989 | 20 | 20 |
| 30 | 42 | 9·720242 | 21 72 | 10·279758 | 9·790292 | 21 99 | 10·209708 | 10·070050 | 21 27 | 9·929950 | 18 | 30 |
| 41 | 44 | 9·720345 | 22 75 | 10·279655 | 9·790434 | 22 104 | 10·209566 | 10·070089 | 22 29 | 9·929911 | 16 | 19 |
| 30 | 46 | 9·720447 | 23 79 | 10·279553 | 9·790575 | 23 108 | 10·209425 | 10·070128 | 23 30 | 9·929872 | 14 | 30 |
| 42 | 48 | 9·720549 | 24 82 | 10·279451 | 9·790716 | 24 113 | 10·209284 | 10·070167 | 24 31 | 9·929833 | 12 | 18 |
| 30 | 50 | 9·720652 | 25 86 | 10·279348 | 9·790857 | 25 118 | 10·209143 | 10·070206 | 25 32 | 9·929794 | 10 | 30 |
| 43 | 52 | 9·720754 | 26 89 | 10·279246 | 9·790999 | 26 122 | 10·209001 | 10·070245 | 26 34 | 9·929755 | 8 | 17 |
| 30 | 54 | 9·720856 | 27 92 | 10·279144 | 9·791140 | 27 127 | 10·208860 | 10·070284 | 27 35 | 9·929716 | 6 | 30 |
| 44 | 56 | 9·720958 | 28 96 | 10·279042 | 9·791281 | 28 132 | 10·208719 | 10·070323 | 28 36 | 9·929677 | 4 | 16 |
| 30 | 58 | 9·721060 | 29 99 | 10·278940 | 9·791422 | 29 137 | 10·208578 | 10·070362 | 29 38 | 9·929638 | 2 | 30 |
| 45 | 7 | 9·721162 | 30 103 | 10·278838 | 9·791563 | 30 141 | 10·208437 | 10·070401 | 30 39 | 9·929599 | 53 | 15 |
| 30 | 2 | 9·721264 | 1 3 | 10·278736 | 9·791705 | 1 5 | 10·208295 | 10·070440 | 1 1 | 9·929560 | 58 | 30 |
| 46 | 4 | 9·721366 | 2 7 | 10·278634 | 9·791846 | 2 9 | 10·208154 | 10·070479 | 2 3 | 9·929521 | 56 | 14 |
| 30 | 6 | 9·721468 | 3 10 | 10·278532 | 9·791987 | 3 14 | 10·208013 | 10·070519 | 3 4 | 9·929482 | 54 | 30 |
| 47 | 8 | 9·721570 | 4 14 | 10·278430 | 9·792128 | 4 19 | 10·207872 | 10·070558 | 4 5 | 9·929442 | 52 | 13 |
| 30 | 10 | 9·721672 | 5 17 | 10·278328 | 9·792269 | 5 23 | 10·207731 | 10·070597 | 5 6 | 9·929403 | 50 | 30 |
| 48 | 12 | 9·721774 | 6 20 | 10·278226 | 9·792410 | 6 28 | 10·207590 | 10·070636 | 6 8 | 9·929364 | 48 | 12 |
| 30 | 14 | 9·721876 | 7 24 | 10·278124 | 9·792551 | 7 33 | 10·207449 | 10·070675 | 7 9 | 9·929325 | 46 | 30 |
| 49 | 16 | 9·721978 | 8 27 | 10·278022 | 9·792692 | 8 38 | 10·207308 | 10·070714 | 8 10 | 9·929286 | 44 | 11 |
| 30 | 18 | 9·722080 | 9 30 | 10·277920 | 9·792833 | 9 42 | 10·207167 | 10·070754 | 9 12 | 9·929247 | 42 | 30 |
| 50 | 20 | 9·722181 | 10 34 | 10·277819 | 9·792974 | 10 47 | 10·207026 | 10·070793 | 10 13 | 9·929207 | 40 | 10 |
| 30 | 22 | 9·722283 | 11 37 | 10·277717 | 9·793115 | 11 52 | 10·206885 | 10·070832 | 11 14 | 9·929168 | 38 | 30 |
| 51 | 24 | 9·722385 | 12 41 | 10·277615 | 9·793256 | 12 56 | 10·206744 | 10·070871 | 12 16 | 9·929129 | 36 | 9 |
| 30 | 26 | 9·722487 | 13 44 | 10·277513 | 9·793397 | 13 61 | 10·206603 | 10·070910 | 13 17 | 9·929090 | 34 | 30 |
| 52 | 28 | 9·722588 | 14 48 | 10·277412 | 9·793538 | 14 66 | 10·206462 | 10·070950 | 14 18 | 9·929050 | 32 | 8 |
| 30 | 30 | 9·722690 | 15 51 | 10·277310 | 9·793679 | 15 70 | 10·206321 | 10·070989 | 15 20 | 9·929011 | 30 | 30 |
| 53 | 32 | 9·722791 | 16 55 | 10·277209 | 9·793819 | 16 75 | 10·206181 | 10·071028 | 16 21 | 9·928972 | 28 | 7 |
| 30 | 34 | 9·722893 | 17 58 | 10·277107 | 9·793960 | 17 80 | 10·206040 | 10·071068 | 17 22 | 9·928933 | 26 | 30 |
| 54 | 36 | 9·722994 | 18 61 | 10·277006 | 9·794101 | 18 84 | 10·205899 | 10·071107 | 18 24 | 9·928893 | 24 | 6 |
| 30 | 38 | 9·723096 | 19 64 | 10·276904 | 9·794242 | 19 89 | 10·205758 | 10·071146 | 19 25 | 9·928854 | 22 | 30 |
| 55 | 40 | 9·723197 | 20 68 | 10·276803 | 9·794383 | 20 94 | 10·205617 | 10·071185 | 20 26 | 9·928815 | 20 | 5 |
| 30 | 42 | 9·723299 | 21 71 | 10·276701 | 9·794523 | 21 98 | 10·205477 | 10·071225 | 21 28 | 9·928775 | 18 | 30 |
| 56 | 44 | 9·723400 | 22 75 | 10·276600 | 9·794664 | 22 103 | 10·205336 | 10·071264 | 22 29 | 9·928736 | 16 | 4 |
| 30 | 46 | 9·723501 | 23 78 | 10·276499 | 9·794805 | 23 108 | 10·205195 | 10·071304 | 23 30 | 9·928696 | 14 | 30 |
| 57 | 48 | 9·723603 | 24 82 | 10·276397 | 9·794946 | 24 113 | 10·205054 | 10·071343 | 24 31 | 9·928657 | 12 | 3 |
| 30 | 50 | 9·723704 | 25 85 | 10·276296 | 9·795086 | 25 117 | 10·204914 | 10·071382 | 25 33 | 9·928618 | 10 | 30 |
| 58 | 52 | 9·723805 | 26 89 | 10·276195 | 9·795227 | 26 122 | 10·204773 | 10·071422 | 26 34 | 9·928578 | 8 | 2 |
| 30 | 54 | 9·723906 | 27 92 | 10·276094 | 9·795367 | 27 127 | 10·204633 | 10·071461 | 27 35 | 9·928539 | 6 | 30 |
| 59 | 56 | 9·724007 | 28 95 | 10·275993 | 9·795508 | 28 131 | 10·204492 | 10·071501 | 28 37 | 9·928499 | 4 | 1 |
| 30 | 58 | 9·724109 | 29 98 | 10·275891 | 9·795649 | 29 136 | 10·204351 | 10·071540 | 29 38 | 9·928460 | 2 | 30 |
| 60 | 8 | 9·724210 | 30 102 | 10·275790 | 9·795789 | 30 141 | 10·204211 | 10·071580 | 30 39 | 9·928420 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

58° — 3h 52m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

$2^h\ 8^m$ — 32°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·724210 | | 10·275790 | 9·795789 | | 10·204211 | 10·071580 | | 9·928420 | 52 | 60 |
| 30 | 2 | 9·724311 | 1″ 3 | 10·275689 | 9·795930 | 1″ 5 | 10·204070 | 10·071619 | 1″ 1 | 9·928381 | 58 | 30 |
| 1 | 4 | 9·724412 | 2 7 | 10·275588 | 9·796070 | 2 9 | 10·203930 | 10·071658 | 2 3 | 9·928342 | 56 | 59 |
| 30 | 6 | 9·724513 | 3 10 | 10·275487 | 9·796211 | 3 14 | 10·203789 | 10·071698 | 3 4 | 9·928302 | 54 | 30 |
| 2 | 8 | 9·724614 | 4 13 | 10·275386 | 9·796351 | 4 19 | 10·203649 | 10·071737 | 4 5 | 9·928263 | 52 | 58 |
| 30 | 10 | 9·724715 | 5 17 | 10·275285 | 9·796492 | 5 23 | 10·203508 | 10·071777 | 5 7 | 9·928223 | 50 | 30 |
| 3 | 12 | 9·724816 | 6 20 | 10·275184 | 9·796632 | 6 28 | 10·203368 | 10·071817 | 6 8 | 9·928183 | 48 | 57 |
| 30 | 14 | 9·724917 | 7 23 | 10·275083 | 9·796773 | 7 33 | 10·203227 | 10·071856 | 7 9 | 9·928144 | 46 | 30 |
| 4 | 16 | 9·725017 | 8 27 | 10·274983 | 9·796913 | 8 37 | 10·203087 | 10·071896 | 8 11 | 9·928104 | 44 | 56 |
| 30 | 18 | 9·725118 | 9 30 | 10·274882 | 9·797053 | 9 42 | 10·202947 | 10·071935 | 9 12 | 9·928065 | 42 | 30 |
| 5 | 20 | 9·725219 | 10 34 | 10·274781 | 9·797194 | 10 47 | 10·202806 | 10·071975 | 10 13 | 9·928025 | 40 | 55 |
| 30 | 22 | 9·725320 | 11 37 | 10·274680 | 9·797334 | 11 51 | 10·202666 | 10·072015 | 11 15 | 9·927986 | 38 | 30 |
| 6 | 24 | 9·725420 | 12 40 | 10·274580 | 9·797475 | 12 56 | 10·202526 | 10·072054 | 12 16 | 9·927946 | 36 | 54 |
| 30 | 26 | 9·725521 | 13 44 | 10·274479 | 9·797615 | 13 61 | 10·202385 | 10·072094 | 13 17 | 9·927906 | 34 | 30 |
| 7 | 28 | 9·725622 | 14 47 | 10·274378 | 9·797755 | 14 65 | 10·202245 | 10·072133 | 14 18 | 9·927867 | 32 | 53 |
| 30 | 30 | 9·725722 | 15 50 | 10·274278 | 9·797895 | 15 70 | 10·202105 | 10·072173 | 15 20 | 9·927827 | 30 | 30 |
| 8 | 32 | 9·725823 | 16 54 | 10·274177 | 9·798036 | 16 75 | 10·201964 | 10·072213 | 16 21 | 9·927787 | 28 | 52 |
| 30 | 34 | 9·725923 | 17 57 | 10·274076 | 9·798176 | 17 79 | 10·201824 | 10·072252 | 17 22 | 9·927748 | 26 | 30 |
| 9 | 36 | 9·726024 | 18 61 | 10·273976 | 9·798316 | 18 84 | 10·201684 | 10·072292 | 18 24 | 9·927708 | 24 | 51 |
| 30 | 38 | 9·726124 | 19 64 | 10·273875 | 9·798456 | 19 89 | 10·201544 | 10·072332 | 19 25 | 9·927668 | 22 | 30 |
| 10 | 40 | 9·726225 | 20 67 | 10·273775 | 9·798596 | 20 93 | 10·201404 | 10·072371 | 20 26 | 9·927629 | 20 | 50 |
| 30 | 42 | 9·726325 | 21 70 | 10·273675 | 9·798737 | 21 98 | 10·201264 | 10·072411 | 21 28 | 9·927589 | 18 | 30 |
| 11 | 44 | 9·726426 | 22 74 | 10·273574 | 9·798877 | 22 103 | 10·201123 | 10·072451 | 22 29 | 9·927549 | 16 | 49 |
| 30 | 46 | 9·726526 | 23 77 | 10·273474 | 9·799017 | 23 107 | 10·200983 | 10·072491 | 23 30 | 9·927509 | 14 | 30 |
| 12 | 48 | 9·726626 | 24 80 | 10·273374 | 9·799157 | 24 112 | 10·200843 | 10·072530 | 24 32 | 9·927470 | 12 | 48 |
| 30 | 50 | 9·726727 | 25 84 | 10·273273 | 9·799297 | 25 117 | 10·200703 | 10·072570 | 25 33 | 9·927430 | 10 | 30 |
| 13 | 52 | 9·726827 | 26 87 | 10·273173 | 9·799437 | 26 122 | 10·200563 | 10·072610 | 26 34 | 9·927390 | 8 | 47 |
| 30 | 54 | 9·726927 | 27 90 | 10·273073 | 9·799577 | 27 126 | 10·200423 | 10·072650 | 27 36 | 9·927350 | 6 | 30 |
| 14 | 56 | 9·727027 | 28 94 | 10·272973 | 9·799717 | 28 131 | 10·200283 | 10·072690 | 28 37 | 9·927310 | 4 | 46 |
| 30 | 58 | 9·727128 | 29 97 | 10·272872 | 9·799857 | 29 136 | 10·200143 | 10·072730 | 29 38 | 9·927270 | 2 | 30 |
| 15 | **9** | 9·727228 | 30 101 | 10·272772 | 9·799997 | 30 140 | 10·200003 | 10·072769 | 30 40 | 9·927231 | **51** | 45 |
| 30 | 2 | 9·727328 | 1 3 | 10·272672 | 9·800137 | 1 5 | 10·199863 | 10·072809 | 1 1 | 9·927191 | 58 | 30 |
| 16 | 4 | 9·727428 | 2 7 | 10·272572 | 9·800277 | 2 9 | 10·199723 | 10·072849 | 2 3 | 9·927151 | 56 | 44 |
| 30 | 6 | 9·727528 | 3 10 | 10·272472 | 9·800417 | 3 14 | 10·199583 | 10·072889 | 3 4 | 9·927111 | 54 | 30 |
| 17 | 8 | 9·727628 | 4 13 | 10·272372 | 9·800557 | 4 19 | 10·199443 | 10·072929 | 4 5 | 9·927071 | 52 | 43 |
| 30 | 10 | 9·727728 | 5 17 | 10·272272 | 9·800697 | 5 23 | 10·199303 | 10·072969 | 5 7 | 9·927031 | 50 | 30 |
| 18 | 12 | 9·727828 | 6 20 | 10·272172 | 9·800836 | 6 28 | 10·199164 | 10·073009 | 6 8 | 9·926991 | 48 | 42 |
| 30 | 14 | 9·727928 | 7 23 | 10·272072 | 9·800976 | 7 33 | 10·199024 | 10·073049 | 7 9 | 9·926951 | 46 | 30 |
| 19 | 16 | 9·728027 | 8 27 | 10·271972 | 9·801116 | 8 37 | 10·198884 | 10·073089 | 8 11 | 9·926911 | 44 | 41 |
| 30 | 18 | 9·728127 | 9 30 | 10·271873 | 9·801256 | 9 42 | 10·198744 | 10·073129 | 9 12 | 9·926871 | 42 | 30 |
| 20 | 20 | 9·728227 | 10 33 | 10·271773 | 9·801396 | 10 46 | 10·198604 | 10·073169 | 10 13 | 9·926831 | 40 | 40 |
| 30 | 22 | 9·728327 | 11 37 | 10·271673 | 9·801535 | 11 51 | 10·198465 | 10·073209 | 11 15 | 9·926791 | 38 | 30 |
| 21 | 24 | 9·728427 | 12 40 | 10·271573 | 9·801675 | 12 56 | 10·198325 | 10·073249 | 12 16 | 9·926751 | 36 | 39 |
| 30 | 26 | 9·728526 | 13 43 | 10·271474 | 9·801815 | 13 60 | 10·198185 | 10·073289 | 13 17 | 9·926711 | 34 | 30 |
| 22 | 28 | 9·728626 | 14 47 | 10·271374 | 9·801955 | 14 65 | 10·198045 | 10·073329 | 14 19 | 9·926671 | 32 | 38 |
| 30 | 30 | 9·728726 | 15 50 | 10·271274 | 9·802094 | 15 70 | 10·197906 | 10·073369 | 15 20 | 9·926631 | 30 | 30 |
| 23 | 32 | 9·728825 | 16 53 | 10·271175 | 9·802234 | 16 74 | 10·197766 | 10·073409 | 16 21 | 9·926591 | 28 | 37 |
| 30 | 34 | 9·728925 | 17 56 | 10·271075 | 9·802374 | 17 79 | 10·197626 | 10·073449 | 17 23 | 9·926551 | 26 | 30 |
| 24 | 36 | 9·729024 | 18 59 | 10·270976 | 9·802513 | 18 84 | 10·197487 | 10·073489 | 18 24 | 9·926511 | 24 | 36 |
| 30 | 38 | 9·729124 | 19 63 | 10·270876 | 9·802653 | 19 88 | 10·197347 | 10·073529 | 19 25 | 9·926471 | 22 | 30 |
| 25 | 40 | 9·729223 | 20 66 | 10·270777 | 9·802792 | 20 93 | 10·197208 | 10·073569 | 20 27 | 9·926431 | 20 | 35 |
| 30 | 42 | 9·729323 | 21 70 | 10·270677 | 9·802932 | 21 98 | 10·197068 | 10·073609 | 21 28 | 9·926391 | 18 | 30 |
| 26 | 44 | 9·729422 | 22 73 | 10·270578 | 9·803072 | 22 102 | 10·196928 | 10·073649 | 22 29 | 9·926351 | 16 | 34 |
| 30 | 46 | 9·729522 | 23 76 | 10·270478 | 9·803211 | 23 107 | 10·196789 | 10·073689 | 23 31 | 9·926311 | 14 | 30 |
| 27 | 48 | 9·729621 | 24 80 | 10·270379 | 9·803351 | 24 112 | 10·196649 | 10·073730 | 24 32 | 9·926270 | 12 | 33 |
| 30 | 50 | 9·729720 | 25 83 | 10·270280 | 9·803490 | 25 116 | 10·196510 | 10·073770 | 25 33 | 9·926230 | 10 | 30 |
| 28 | 52 | 9·729820 | 26 86 | 10·270180 | 9·803630 | 26 121 | 10·196370 | 10·073810 | 26 35 | 9·926190 | 8 | 32 |
| 30 | 54 | 9·729919 | 27 90 | 10·270081 | 9·803769 | 27 126 | 10·196231 | 10·073850 | 27 36 | 9·926150 | 6 | 30 |
| 29 | 56 | 9·730018 | 28 93 | 10·269982 | 9·803909 | 28 130 | 10·196091 | 10·073890 | 28 38 | 9·926110 | 4 | 31 |
| 30 | 58 | 9·730117 | 29 96 | 10·269883 | 9·804048 | 29 135 | 10·195952 | 10·073931 | 29 39 | 9·926069 | 2 | 30 |
| 30 | **10** | 9·730217 | 30 100 | 10·269784 | 9·804187 | 30 139 | 10·195813 | 10·073971 | 30 40 | 9·926029 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

57° — $3^h\ 50^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

2h 10m — 32°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·730217 | | 10·269783 | 9·804187 | | 10·195813 | 10·073971 | | 9·926029 | **50** | 30 |
| 30 | 2 | 9·730316 | 1″ 3 | 10·269684 | 9·804327 | 1″ 5 | 10·195673 | 10·074011 | 1″ 1 | 9·925989 | 58 | 30 |
| 31 | 4 | 9·730415 | 2 7 | 10·269585 | 9·804466 | 2 9 | 10·195534 | 10·074051 | 2 3 | 9·925949 | 56 | 29 |
| 30 | 6 | 9·730514 | 3 10 | 10·269486 | 9·804605 | 3 14 | 10·195395 | 10·074092 | 3 4 | 9·925908 | 54 | 30 |
| 32 | 8 | 9·730613 | 4 13 | 10·269387 | 9·804745 | 4 19 | 10·195255 | 10·074132 | 4 5 | 9·925868 | 52 | 28 |
| 30 | 10 | 9·730712 | 5 16 | 10·269288 | 9·804884 | 5 23 | 10·195116 | 10·074172 | 5 7 | 9·925828 | 50 | 30 |
| 33 | 12 | 9·730811 | 6 20 | 10·269189 | 9·805023 | 6 28 | 10·194977 | 10·074212 | 6 8 | 9·925788 | 48 | 27 |
| 30 | 14 | 9·730910 | 7 23 | 10·269090 | 9·805163 | 7 32 | 10·194837 | 10·074253 | 7 9 | 9·925747 | 46 | 30 |
| 34 | 16 | 9·731009 | 8 26 | 10·268991 | 9·805302 | 8 37 | 10·194698 | 10·074293 | 8 11 | 9·925707 | 44 | 26 |
| 30 | 18 | 9·731108 | 9 30 | 10·268892 | 9·805441 | 9 42 | 10·194559 | 10·074333 | 9 12 | 9·925667 | 42 | 30 |
| 35 | 20 | 9·731206 | 10 33 | 10·268794 | 9·805580 | 10 46 | 10·194420 | 10·074374 | 10 13 | 9·925626 | 40 | 25 |
| 30 | 22 | 9·731305 | 11 36 | 10·268695 | 9·805719 | 11 51 | 10·194281 | 10·074414 | 11 15 | 9·925586 | 38 | 30 |
| 36 | 24 | 9·731404 | 12 40 | 10·268596 | 9·805859 | 12 56 | 10·194141 | 10·074455 | 12 16 | 9·925545 | 36 | 24 |
| 30 | 26 | 9·731503 | 13 43 | 10·268497 | 9·805998 | 13 60 | 10·194002 | 10·074495 | 13 18 | 9·925505 | 34 | 30 |
| 37 | 28 | 9·731602 | 14 46 | 10·268398 | 9·806137 | 14 65 | 10·193863 | 10·074535 | 14 19 | 9·925465 | 32 | 23 |
| 30 | 30 | 9·731700 | 15 49 | 10·268300 | 9·806276 | 15 70 | 10·193724 | 10·074576 | 15 20 | 9·925424 | 30 | 30 |
| 38 | 32 | 9·731799 | 16 53 | 10·268201 | 9·806415 | 16 74 | 10·193585 | 10·074616 | 16 22 | 9·925384 | 28 | 22 |
| 30 | 34 | 9·731897 | 17 56 | 10·268102 | 9·806554 | 17 79 | 10·193446 | 10·074657 | 17 23 | 9·925343 | 26 | 30 |
| 39 | 36 | 9·731996 | 18 59 | 10·268004 | 9·806693 | 18 83 | 10·193307 | 10·074697 | 18 24 | 9·925303 | 24 | 21 |
| 30 | 38 | 9·732095 | 19 63 | 10·267905 | 9·806832 | 19 88 | 10·193168 | 10·074738 | 19 26 | 9·925262 | 22 | 30 |
| 40 | 40 | 9·732193 | 20 66 | 10·267807 | 9·806971 | 20 93 | 10·193029 | 10·074778 | 20 27 | 9·925222 | 20 | 20 |
| 30 | 42 | 9·732292 | 21 69 | 10·267708 | 9·807110 | 21 97 | 10·192890 | 10·074819 | 21 28 | 9·925181 | 18 | 30 |
| 41 | 44 | 9·732390 | 22 73 | 10·267610 | 9·807249 | 22 102 | 10·192751 | 10·074859 | 22 30 | 9·925141 | 16 | 19 |
| 30 | 46 | 9·732489 | 23 76 | 10·267511 | 9·807388 | 23 107 | 10·192612 | 10·074900 | 23 31 | 9·925100 | 14 | 30 |
| 42 | 48 | 9·732587 | 24 79 | 10·267413 | 9·807527 | 24 111 | 10·192473 | 10·074940 | 24 32 | 9·925060 | 12 | 18 |
| 30 | 50 | 9·732685 | 25 82 | 10·267315 | 9·807666 | 25 116 | 10·192334 | 10·074981 | 25 34 | 9·925019 | 10 | 30 |
| 43 | 52 | 9·732784 | 26 86 | 10·267216 | 9·807805 | 26 121 | 10·192195 | 10·075021 | 26 35 | 9·924979 | 8 | 17 |
| 30 | 54 | 9·732882 | 27 89 | 10·267118 | 9·807944 | 27 125 | 10·192056 | 10·075062 | 27 36 | 9·924938 | 6 | 30 |
| 44 | 56 | 9·732980 | 28 92 | 10·267020 | 9·808083 | 28 130 | 10·191917 | 10·075103 | 28 38 | 9·924897 | 4 | 16 |
| 30 | 58 | 9·733079 | 29 95 | 10·266921 | 9·808222 | 29 134 | 10·191778 | 10·075143 | 29 39 | 9·924857 | 2 | 30 |
| 45 | **11** | 9·733177 | 30 99 | 10·266823 | 9·808361 | 30 139 | 10·191639 | 10·075184 | 30 40 | 9·924816 | **49** | 15 |
| 30 | 2 | 9·733275 | 1 3 | 10·266725 | 9·808499 | 1 5 | 10·191501 | 10·075224 | 1 1 | 9·924776 | 58 | 30 |
| 46 | 4 | 9·733373 | 2 6 | 10·266627 | 9·808638 | 2 9 | 10·191362 | 10·075265 | 2 3 | 9·924735 | 56 | 14 |
| 30 | 6 | 9·733471 | 3 10 | 10·266529 | 9·808777 | 3 14 | 10·191223 | 10·075306 | 3 4 | 9·924694 | 54 | 30 |
| 47 | 8 | 9·733569 | 4 13 | 10·266431 | 9·808916 | 4 18 | 10·191084 | 10·075346 | 4 5 | 9·924654 | 52 | 13 |
| 30 | 10 | 9·733667 | 5 16 | 10·266333 | 9·809055 | 5 23 | 10·190945 | 10·075387 | 5 7 | 9·924613 | 50 | 30 |
| 48 | 12 | 9·733765 | 6 20 | 10·266235 | 9·809193 | 6 28 | 10·190807 | 10·075428 | 6 8 | 9·924572 | 48 | 12 |
| 30 | 14 | 9·733863 | 7 23 | 10·266137 | 9·809332 | 7 32 | 10·190668 | 10·075469 | 7 10 | 9·924531 | 46 | 30 |
| 49 | 16 | 9·733961 | 8 26 | 10·266039 | 9·809471 | 8 37 | 10·190529 | 10·075509 | 8 11 | 9·924491 | 44 | 11 |
| 30 | 18 | 9·734059 | 9 29 | 10·265941 | 9·809609 | 9 42 | 10·190391 | 10·075550 | 9 12 | 9·924450 | 42 | 30 |
| 50 | 20 | 9·734157 | 10 33 | 10·265843 | 9·809748 | 10 46 | 10·190252 | 10·075591 | 10 14 | 9·924409 | 40 | 10 |
| 30 | 22 | 9·734255 | 11 36 | 10·265745 | 9·809887 | 11 51 | 10·190113 | 10·075632 | 11 15 | 9·924368 | 38 | 30 |
| 51 | 24 | 9·734353 | 12 39 | 10·265647 | 9·810025 | 12 55 | 10·189975 | 10·075672 | 12 16 | 9·924328 | 36 | 9 |
| 30 | 26 | 9·734451 | 13 42 | 10·265549 | 9·810164 | 13 60 | 10·189836 | 10·075713 | 13 18 | 9·924287 | 34 | 30 |
| 52 | 28 | 9·734549 | 14 46 | 10·265451 | 9·810302 | 14 65 | 10·189698 | 10·075754 | 14 19 | 9·924246 | 32 | 8 |
| 30 | 30 | 9·734646 | 15 49 | 10·265354 | 9·810441 | 15 69 | 10·189559 | 10·075795 | 15 20 | 9·924205 | 30 | 30 |
| 53 | 32 | 9·734744 | 16 52 | 10·265256 | 9·810580 | 16 74 | 10·189420 | 10·075836 | 16 22 | 9·924164 | 28 | 7 |
| 30 | 34 | 9·734842 | 17 55 | 10·265158 | 9·810718 | 17 79 | 10·189282 | 10·075876 | 17 23 | 9·924124 | 26 | 30 |
| 54 | 36 | 9·734939 | 18 59 | 10·265061 | 9·810857 | 18 83 | 10·189143 | 10·075917 | 18 24 | 9·924083 | 24 | 6 |
| 30 | 38 | 9·735037 | 19 62 | 10·264963 | 9·810995 | 19 88 | 10·189005 | 10·075958 | 19 26 | 9·924042 | 22 | 30 |
| 55 | 40 | 9·735135 | 20 65 | 10·264865 | 9·811134 | 20 92 | 10·188866 | 10·075999 | 20 27 | 9·924001 | 20 | 5 |
| 30 | 42 | 9·735232 | 21 68 | 10·264768 | 9·811272 | 21 97 | 10·188728 | 10·076040 | 21 29 | 9·923960 | 18 | 30 |
| 56 | 44 | 9·735330 | 22 72 | 10·264670 | 9·811410 | 22 102 | 10·188590 | 10·076081 | 22 30 | 9·923919 | 16 | 4 |
| 30 | 46 | 9·735427 | 23 75 | 10·264573 | 9·811549 | 23 106 | 10·188451 | 10·076122 | 23 31 | 9·923878 | 14 | 30 |
| 57 | 48 | 9·735525 | 24 78 | 10·264475 | 9·811687 | 24 111 | 10·188313 | 10·076163 | 24 33 | 9·923837 | 12 | 3 |
| 30 | 50 | 9·735622 | 25 82 | 10·264378 | 9·811826 | 25 116 | 10·188174 | 10·076204 | 25 34 | 9·923796 | 10 | 30 |
| 58 | 52 | 9·735719 | 26 85 | 10·264281 | 9·811964 | 26 120 | 10·188036 | 10·076245 | 26 35 | 9·923755 | 8 | 2 |
| 30 | 54 | 9·735817 | 27 88 | 10·264183 | 9·812102 | 27 125 | 10·187898 | 10·076286 | 27 37 | 9·923714 | 6 | 30 |
| 59 | 56 | 9·735914 | 28 91 | 10·264086 | 9·812241 | 28 129 | 10·187759 | 10·076327 | 28 38 | 9·923673 | 4 | 1 |
| 30 | 58 | 9·736011 | 29 95 | 10·263989 | 9·812379 | 29 134 | 10·187621 | 10·076368 | 29 39 | 9·923632 | 2 | 30 |
| 60 | **12** | 9·736109 | 30 98 | 10·263891 | 9·812517 | 30 139 | 10·187483 | 10·076409 | 30 41 | 9·923591 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

57° — 3h 48m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

| 2ʰ 12ᵐ | | | | | 33° | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 0 | 0 | 9·736109 | | 10·263891 | 9·812517 | | 10·187483 | 10·076409 | | 9·923591 | 48 | 60 |
| 30 | 2 | 9·736206 | 1″ 3 | 10·263794 | 9·812656 | 1″ 5 | 10·187344 | 10·076450 | 1″ 1 | 9·923550 | 58 | 30 |
| 1 | 4 | 9·736303 | 2 6 | 10·263697 | 9·812794 | 2 9 | 10·187206 | 10·076491 | 2 3 | 9·923509 | 56 | 59 |
| 30 | 6 | 9·736400 | 3 10 | 10·263600 | 9·812932 | 3 14 | 10·187068 | 10·076532 | 3 4 | 9·923468 | 54 | 30 |
| 2 | 8 | 9·736498 | 4 13 | 10·263502 | 9·813070 | 4 18 | 10·186930 | 10·076573 | 4 5 | 9·923427 | 52 | 58 |
| 30 | 10 | 9·736595 | 5 16 | 10·263405 | 9·813209 | 5 23 | 10·186791 | 10·076614 | 5 7 | 9·923386 | 50 | 30 |
| 3 | 12 | 9·736692 | 6 19 | 10·263308 | 9·813347 | 6 28 | 10·186653 | 10·076655 | 6 8 | 9·923345 | 48 | 57 |
| 30 | 14 | 9·736789 | 7 23 | 10·263211 | 9·813485 | 7 32 | 10·186515 | 10·076696 | 7 10 | 9·923304 | 46 | 30 |
| 4 | 16 | 9·736886 | 8 26 | 10·263114 | 9·813623 | 8 37 | 10·186377 | 10·076737 | 8 11 | 9·923263 | 44 | 56 |
| 30 | 18 | 9·736983 | 9 29 | 10·263017 | 9·813761 | 9 41 | 10·186239 | 10·076778 | 9 12 | 9·923222 | 42 | 30 |
| 5 | 20 | 9·737080 | 10 32 | 10·262920 | 9·813899 | 10 46 | 10·186101 | 10·076819 | 10 14 | 9·923181 | 40 | 55 |
| 30 | 22 | 9·737177 | 11 36 | 10·262823 | 9·814037 | 11 51 | 10·185963 | 10·076861 | 11 15 | 9·923139 | 38 | 30 |
| 6 | 24 | 9·737274 | 12 39 | 10·262726 | 9·814176 | 12 55 | 10·185824 | 10·076902 | 12 17 | 9·923098 | 36 | 54 |
| 30 | 26 | 9·737371 | 13 42 | 10·262629 | 9·814314 | 13 60 | 10·185686 | 10·076943 | 13 18 | 9·923057 | 34 | 30 |
| 7 | 28 | 9·737467 | 14 45 | 10·262533 | 9·814452 | 14 64 | 10·185548 | 10·076984 | 14 19 | 9·923016 | 32 | 53 |
| 30 | 30 | 9·737564 | 15 48 | 10·262436 | 9·814590 | 15 69 | 10·185410 | 10·077025 | 15 21 | 9·922975 | 30 | 30 |
| 8 | 32 | 9·737661 | 16 51 | 10·262339 | 9·814728 | 16 74 | 10·185272 | 10·077067 | 16 22 | 9·922933 | 28 | 52 |
| 30 | 34 | 9·737758 | 17 55 | 10·262242 | 9·814866 | 17 78 | 10·185134 | 10·077108 | 17 23 | 9·922892 | 26 | 30 |
| 9 | 36 | 9·737855 | 18 58 | 10·262145 | 9·815004 | 18 83 | 10·184996 | 10·077149 | 18 25 | 9·922851 | 24 | 51 |
| 30 | 38 | 9·737951 | 19 61 | 10·262049 | 9·815142 | 19 87 | 10·184858 | 10·077190 | 19 26 | 9·922810 | 22 | 30 |
| 10 | 40 | 9·738048 | 20 64 | 10·261952 | 9·815280 | 20 92 | 10·184720 | 10·077232 | 20 27 | 9·922768 | 20 | 50 |
| 30 | 42 | 9·738145 | 21 68 | 10·261855 | 9·815417 | 21 97 | 10·184583 | 10·077273 | 21 29 | 9·922727 | 18 | 30 |
| 11 | 44 | 9·738241 | 22 71 | 10·261759 | 9·815555 | 22 101 | 10·184445 | 10·077314 | 22 30 | 9·922686 | 16 | 49 |
| 30 | 46 | 9·738338 | 23 74 | 10·261662 | 9·815693 | 23 106 | 10·184307 | 10·077356 | 23 32 | 9·922644 | 14 | 30 |
| 12 | 48 | 9·738434 | 24 77 | 10·261566 | 9·815831 | 24 110 | 10·184169 | 10·077397 | 24 33 | 9·922603 | 12 | 48 |
| 30 | 50 | 9·738531 | 25 81 | 10·261469 | 9·815969 | 25 115 | 10·184031 | 10·077438 | 25 34 | 9·922562 | 10 | 30 |
| 13 | 52 | 9·738627 | 26 84 | 10·261373 | 9·816107 | 26 120 | 10·183893 | 10·077480 | 26 36 | 9·922520 | 8 | 47 |
| 30 | 54 | 9·738724 | 27 87 | 10·261276 | 9·816245 | 27 124 | 10·183755 | 10·077521 | 27 37 | 9·922479 | 6 | 30 |
| 14 | 56 | 9·738820 | 28 90 | 10·261180 | 9·816382 | 28 129 | 10·183618 | 10·077562 | 28 38 | 9·922438 | 4 | 46 |
| 30 | 58 | 9·738917 | 29 94 | 10·261083 | 9·816520 | 29 133 | 10·183480 | 10·077604 | 29 40 | 9·922396 | 2 | 30 |
| 15 | 13 | 9·739013 | 30 97 | 10·260987 | 9·816658 | 30 138 | 10·183342 | 10·077645 | 30 41 | 9·922355 | 47 | 45 |
| 30 | 2 | 9·739109 | 1 3 | 10·260891 | 9·816796 | 1 5 | 10·183204 | 10·077687 | 1 1 | 9·922313 | 58 | 30 |
| 16 | 4 | 9·739206 | 2 6 | 10·260794 | 9·816933 | 2 9 | 10·183067 | 10·077728 | 2 3 | 9·922272 | 56 | 44 |
| 30 | 6 | 9·739302 | 3 10 | 10·260698 | 9·817071 | 3 14 | 10·182929 | 10·077769 | 3 4 | 9·922231 | 54 | 30 |
| 17 | 8 | 9·739398 | 4 13 | 10·260602 | 9·817209 | 4 18 | 10·182791 | 10·077811 | 4 6 | 9·922189 | 52 | 43 |
| 30 | 10 | 9·739494 | 5 16 | 10·260506 | 9·817347 | 5 23 | 10·182653 | 10·077852 | 5 7 | 9·922148 | 50 | 30 |
| 18 | 12 | 9·739590 | 6 19 | 10·260410 | 9·817484 | 6 27 | 10·182516 | 10·077894 | 6 8 | 9·922106 | 48 | 42 |
| 30 | 14 | 9·739687 | 7 22 | 10·260313 | 9·817622 | 7 32 | 10·182378 | 10·077935 | 7 10 | 9·922065 | 46 | 30 |
| 19 | 16 | 9·739783 | 8 26 | 10·260217 | 9·817759 | 8 37 | 10·182241 | 10·077977 | 8 11 | 9·922023 | 44 | 41 |
| 30 | 18 | 9·739879 | 9 29 | 10·260121 | 9·817897 | 9 41 | 10·182103 | 10·078018 | 9 13 | 9·921982 | 42 | 30 |
| 20 | 20 | 9·739975 | 10 32 | 10·260025 | 9·818035 | 10 46 | 10·181965 | 10·078060 | 10 14 | 9·921940 | 40 | 40 |
| 30 | 22 | 9·740071 | 11 35 | 10·259929 | 9·818172 | 11 50 | 10·181828 | 10·078101 | 11 15 | 9·921899 | 38 | 30 |
| 21 | 24 | 9·740167 | 12 38 | 10·259833 | 9·818310 | 12 55 | 10·181690 | 10·078143 | 12 17 | 9·921857 | 36 | 39 |
| 30 | 26 | 9·740263 | 13 42 | 10·259737 | 9·818447 | 13 60 | 10·181553 | 10·078185 | 13 18 | 9·921815 | 34 | 30 |
| 22 | 28 | 9·740359 | 14 45 | 10·259641 | 9·818585 | 14 64 | 10·181415 | 10·078226 | 14 19 | 9·921774 | 32 | 38 |
| 30 | 30 | 9·740455 | 15 48 | 10·259545 | 9·818722 | 15 69 | 10·181278 | 10·078268 | 15 21 | 9·921732 | 30 | 30 |
| 23 | 32 | 9·740550 | 16 51 | 10·259450 | 9·818860 | 16 73 | 10·181140 | 10·078309 | 16 22 | 9·921691 | 28 | 37 |
| 30 | 34 | 9·740646 | 17 54 | 10·259354 | 9·818997 | 17 78 | 10·181003 | 10·078351 | 17 24 | 9·921649 | 26 | 30 |
| 24 | 36 | 9·740742 | 18 57 | 10·259258 | 9·819135 | 18 82 | 10·180865 | 10·078393 | 18 25 | 9·921607 | 24 | 36 |
| 30 | 38 | 9·740838 | 19 61 | 10·259162 | 9·819272 | 19 87 | 10·180728 | 10·078434 | 19 26 | 9·921566 | 22 | 30 |
| 25 | 40 | 9·740934 | 20 64 | 10·259066 | 9·819410 | 20 92 | 10·180590 | 10·078476 | 20 28 | 9·921524 | 20 | 35 |
| 30 | 42 | 9·741029 | 21 67 | 10·258971 | 9·819547 | 21 96 | 10·180453 | 10·078518 | 21 29 | 9·921482 | 18 | 30 |
| 26 | 44 | 9·741125 | 22 70 | 10·258875 | 9·819684 | 22 101 | 10·180316 | 10·078559 | 22 31 | 9·921441 | 16 | 34 |
| 30 | 46 | 9·741221 | 23 74 | 10·258779 | 9·819822 | 23 105 | 10·180178 | 10·078601 | 23 32 | 9·921399 | 14 | 30 |
| 27 | 48 | 9·741316 | 24 77 | 10·258684 | 9·819959 | 24 110 | 10·180041 | 10·078643 | 24 33 | 9·921357 | 12 | 33 |
| 30 | 50 | 9·741412 | 25 80 | 10·258588 | 9·820096 | 25 114 | 10·179904 | 10·078685 | 25 35 | 9·921315 | 10 | 30 |
| 28 | 52 | 9·741508 | 26 83 | 10·258492 | 9·820234 | 26 119 | 10·179766 | 10·078726 | 26 36 | 9·921274 | 8 | 32 |
| 30 | 54 | 9·741603 | 27 86 | 10·258397 | 9·820371 | 27 124 | 10·179629 | 10·078768 | 27 38 | 9·921232 | 6 | 30 |
| 29 | 56 | 9·741699 | 28 89 | 10·258301 | 9·820508 | 28 128 | 10·179492 | 10·078810 | 28 39 | 9·921190 | 4 | 31 |
| 30 | 58 | 9·741794 | 29 93 | 10·258206 | 9·820646 | 29 133 | 10·179354 | 10·078852 | 29 40 | 9·921148 | 2 | 30 |
| 30 | 14 | 9·741889 | 30 96 | 10·258111 | 9·820783 | 30 137 | 10·179217 | 10·078893 | 30 42 | 9·921107 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | 56° | | | | | | 3ʰ 46ᵐ | |

TABLE XXVI.—(*continued*).

LOG. SINES. COSINES, &c.

2h 14m — 33°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·741889 | | 10·258111 | 9·820783 | | 10·179217 | 10·078893 | | 9·921107 | 46 | 30 |
| 30 | 2 | 9·741985 | 1″ 3 | 10·258015 | 9·820920 | 1″ 5 | 10·179080 | 10·078935 | 1″ 1 | 9·921065 | 58 | 30 |
| 31 | 4 | 9·742080 | 2 6 | 10·257920 | 9·821057 | 2 9 | 10·178943 | 10·078977 | 2 3 | 9·921023 | 56 | 29 |
| 30 | 6 | 9·742176 | 3 9 | 10·257824 | 9·821195 | 3 14 | 10·178805 | 10·079019 | 3 4 | 9·920981 | 54 | 30 |
| 32 | 8 | 9·742271 | 4 13 | 10·257729 | 9·821332 | 4 18 | 10·178668 | 10·079061 | 4 6 | 9·920939 | 52 | 28 |
| 30 | 10 | 9·742366 | 5 16 | 10·257634 | 9·821469 | 5 23 | 10·178531 | 10·079103 | 5 7 | 9·920897 | 50 | 30 |
| 33 | 12 | 9·742462 | 6 19 | 10·257538 | 9·821606 | 6 27 | 10·178394 | 10·079144 | 6 8 | 9·920856 | 48 | 27 |
| 30 | 14 | 9·742557 | 7 22 | 10·257443 | 9·821743 | 7 32 | 10·178257 | 10·079186 | 7 10 | 9·920814 | 46 | 30 |
| 34 | 16 | 9·742652 | 8 25 | 10·257348 | 9·821880 | 8 37 | 10·178120 | 10·079228 | 8 11 | 9·920772 | 44 | 26 |
| 30 | 18 | 9·742747 | 9 28 | 10·257253 | 9·822017 | 9 41 | 10·177983 | 10·079270 | 9 13 | 9·920730 | 42 | 30 |
| 35 | 20 | 9·742842 | 10 32 | 10·257158 | 9·822154 | 10 46 | 10·177846 | 10·079312 | 10 14 | 9·920688 | 40 | 25 |
| 30 | 22 | 9·742937 | 11 35 | 10·257063 | 9·822292 | 11 50 | 10·177708 | 10·079354 | 11 15 | 9·920646 | 38 | 30 |
| 36 | 24 | 9·743033 | 12 38 | 10·256967 | 9·822429 | 12 55 | 10·177571 | 10·079396 | 12 17 | 9·920604 | 36 | 24 |
| 30 | 26 | 9·743128 | 13 41 | 10·256872 | 9·822566 | 13 59 | 10·177434 | 10·079438 | 13 18 | 9·920562 | 34 | 30 |
| 37 | 28 | 9·743223 | 14 44 | 10·256777 | 9·822703 | 14 64 | 10·177297 | 10·079480 | 14 20 | 9·920520 | 32 | 23 |
| 30 | 30 | 9·743318 | 15 48 | 10·256682 | 9·822840 | 15 69 | 10·177160 | 10·079522 | 15 21 | 9·920478 | 30 | 30 |
| 38 | 32 | 9·743413 | 16 51 | 10·256587 | 9·822977 | 16 73 | 10·177023 | 10·079564 | 16 22 | 9·920436 | 28 | 22 |
| 30 | 34 | 9·743508 | 17 54 | 10·256492 | 9·823114 | 17 78 | 10·176886 | 10·079606 | 17 24 | 9·920394 | 26 | 30 |
| 39 | 36 | 9·743602 | 18 57 | 10·256398 | 9·823251 | 18 82 | 10·176749 | 10·079648 | 18 25 | 9·920352 | 24 | 21 |
| 30 | 38 | 9·743697 | 19 60 | 10·256303 | 9·823387 | 19 87 | 10·176613 | 10·079690 | 19 27 | 9·920310 | 22 | 30 |
| 40 | 40 | 9·743792 | 20 63 | 10·256208 | 9·823524 | 20 91 | 10·176476 | 10·079732 | 20 28 | 9·920268 | 20 | 20 |
| 30 | 42 | 9·743887 | 21 67 | 10·256113 | 9·823661 | 21 96 | 10·176339 | 10·079774 | 21 29 | 9·920226 | 18 | 30 |
| 41 | 44 | 9·743982 | 22 70 | 10·256018 | 9·823798 | 22 101 | 10·176202 | 10·079816 | 22 31 | 9·920184 | 16 | 19 |
| 30 | 46 | 9·744077 | 23 73 | 10·255923 | 9·823935 | 23 105 | 10·176065 | 10·079859 | 23 32 | 9·920141 | 14 | 30 |
| 42 | 48 | 9·744171 | 24 76 | 10·255829 | 9·824072 | 24 110 | 10·175928 | 10·079901 | 24 34 | 9·920099 | 12 | 18 |
| 30 | 50 | 9·744266 | 25 79 | 10·255734 | 9·824209 | 25 114 | 10·175791 | 10·079943 | 25 35 | 9·920057 | 10 | 30 |
| 43 | 52 | 9·744361 | 26 82 | 10·255639 | 9·824345 | 26 119 | 10·175655 | 10·079985 | 26 36 | 9·920015 | 8 | 17 |
| 30 | 54 | 9·744455 | 27 86 | 10·255545 | 9·824482 | 27 123 | 10·175518 | 10·080027 | 27 38 | 9·919973 | 6 | 30 |
| 44 | 56 | 9·744550 | 28 89 | 10·255450 | 9·824619 | 28 128 | 10·175381 | 10·080069 | 28 39 | 9·919931 | 4 | 16 |
| 30 | 58 | 9·744644 | 29 92 | 10·255356 | 9·824756 | 29 133 | 10·175244 | 10·080111 | 29 41 | 9·919889 | 2 | 30 |
| 45 | **15** | 9·744739 | 30 95 | 10·255261 | 9·824893 | 30 137 | 10·175107 | 10·080154 | 30 42 | 9·919846 | **45** | 15 |
| 30 | 2 | 9·744833 | 1 3 | 10·255167 | 9·825029 | 1 5 | 10·174971 | 10·080196 | 1 1 | 9·919804 | 58 | 30 |
| 46 | 4 | 9·744928 | 2 6 | 10·255072 | 9·825166 | 2 9 | 10·174834 | 10·080238 | 2 3 | 9·919762 | 56 | 14 |
| 30 | 6 | 9·745022 | 3 9 | 10·254978 | 9·825303 | 3 14 | 10·174697 | 10·080280 | 3 4 | 9·919720 | 54 | 30 |
| 47 | 8 | 9·745117 | 4 13 | 10·254883 | 9·825439 | 4 18 | 10·174561 | 10·080323 | 4 6 | 9·919677 | 52 | 13 |
| 30 | 10 | 9·745211 | 5 16 | 10·254789 | 9·825576 | 5 23 | 10·174424 | 10·080365 | 5 7 | 9·919635 | 50 | 30 |
| 48 | 12 | 9·745306 | 6 19 | 10·254694 | 9·825713 | 6 27 | 10·174287 | 10·080407 | 6 8 | 9·919593 | 48 | 12 |
| 30 | 14 | 9·745400 | 7 22 | 10·254600 | 9·825849 | 7 32 | 10·174151 | 10·080449 | 7 10 | 9·919551 | 46 | 30 |
| 49 | 16 | 9·745494 | 8 25 | 10·254506 | 9·825986 | 8 36 | 10·174014 | 10·080492 | 8 11 | 9·919508 | 44 | 11 |
| 30 | 18 | 9·745589 | 9 28 | 10·254411 | 9·826123 | 9 41 | 10·173877 | 10·080534 | 9 13 | 9·919466 | 42 | 30 |
| 50 | 20 | 9·745683 | 10 31 | 10·254317 | 9·826259 | 10 45 | 10·173741 | 10·080576 | 10 14 | 9·919424 | 40 | 10 |
| 30 | 22 | 9·745777 | 11 35 | 10·254223 | 9·826396 | 11 50 | 10·173604 | 10·080619 | 11 16 | 9·919381 | 38 | 30 |
| 51 | 24 | 9·745871 | 12 38 | 10·254129 | 9·826532 | 12 55 | 10·173468 | 10·080661 | 12 17 | 9·919339 | 36 | 9 |
| 30 | 26 | 9·745965 | 13 41 | 10·254035 | 9·826669 | 13 59 | 10·173331 | 10·080703 | 13 18 | 9·919297 | 34 | 30 |
| 52 | 28 | 9·746060 | 14 44 | 10·253940 | 9·826805 | 14 64 | 10·173195 | 10·080746 | 14 20 | 9·919254 | 32 | 8 |
| 30 | 30 | 9·746154 | 15 47 | 10·253846 | 9·826942 | 15 68 | 10·173058 | 10·080788 | 15 21 | 9·919212 | 30 | 30 |
| 53 | 32 | 9·746248 | 16 50 | 10·253752 | 9·827078 | 16 73 | 10·172922 | 10·080831 | 16 23 | 9·919169 | 28 | 7 |
| 30 | 34 | 9·746342 | 17 53 | 10·253658 | 9·827215 | 17 77 | 10·172785 | 10·080873 | 17 24 | 9·919127 | 26 | 30 |
| 54 | 36 | 9·746436 | 18 56 | 10·253564 | 9·827351 | 18 82 | 10·172649 | 10·080915 | 18 25 | 9·919085 | 24 | 6 |
| 30 | 38 | 9·746530 | 19 60 | 10·253470 | 9·827488 | 19 86 | 10·172512 | 10·080958 | 19 27 | 9·919042 | 22 | 30 |
| 55 | 40 | 9·746624 | 20 63 | 10·253376 | 9·827624 | 20 91 | 10·172376 | 10·081000 | 20 28 | 9·919000 | 20 | 5 |
| 30 | 42 | 9·746718 | 21 66 | 10·253282 | 9·827761 | 21 96 | 10·172239 | 10·081043 | 21 30 | 9·918957 | 18 | 30 |
| 56 | 44 | 9·746812 | 22 69 | 10·253188 | 9·827897 | 22 100 | 10·172103 | 10·081085 | 22 31 | 9·918915 | 16 | 4 |
| 30 | 46 | 9·746905 | 23 72 | 10·253095 | 9·828033 | 23 105 | 10·171967 | 10·081128 | 23 32 | 9·918872 | 14 | 30 |
| 57 | 48 | 9·746999 | 24 75 | 10·253001 | 9·828170 | 24 109 | 10·171830 | 10·081170 | 24 34 | 9·918830 | 12 | 3 |
| 30 | 50 | 9·747093 | 25 79 | 10·252907 | 9·828306 | 25 114 | 10·171694 | 10·081213 | 25 35 | 9·918787 | 10 | 30 |
| 58 | 52 | 9·747187 | 26 82 | 10·252813 | 9·828442 | 26 118 | 10·171558 | 10·081255 | 26 37 | 9·918745 | 8 | 2 |
| 30 | 54 | 9·747281 | 27 85 | 10·252719 | 9·828579 | 27 123 | 10·171421 | 10·081298 | 27 38 | 9·918702 | 6 | 30 |
| 59 | 56 | 9·747374 | 28 88 | 10·252626 | 9·828715 | 28 127 | 10·171285 | 10·081341 | 28 39 | 9·918659 | 4 | 1 |
| 30 | 58 | 9·747468 | 29 91 | 10·252532 | 9·828851 | 29 132 | 10·171149 | 10·081383 | 29 41 | 9·918617 | 2 | 30 |
| 60 | **16** | 9·747562 | 30 94 | 10·252438 | 9·828987 | 30 136 | 10·171013 | 10·081426 | 30 42 | 9·918574 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

56° — 3h 44m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

| 2h 16m | | | | | | 34° | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 0 | 0 | 9·747562 | | 10·252438 | 9·828987 | | 10·171013 | 10·081426 | | 9·918574 | **44** | 60 |
| 30 | 2 | 9·747655 | 1″ 3 | 10·252345 | 9·829124 | 1″ 5 | 10·170876 | 10·081468 | 1″ 1 | 9·918532 | 58 | 30 |
| 1 | 4 | 9·747749 | 2 6 | 10·252251 | 9·829260 | 2 9 | 10·170740 | 10·081511 | 2 3 | 9·918489 | 56 | 59 |
| 30 | 6 | 9·747842 | 3 9 | 10·252158 | 9·829396 | 3 14 | 10·170604 | 10·081554 | 3 4 | 9·918446 | 54 | 30 |
| 2 | 8 | 9·747936 | 4 12 | 10·252064 | 9·829532 | 4 18 | 10·170468 | 10·081596 | 4 6 | 9·918404 | 52 | 58 |
| 30 | 10 | 9·748030 | 5 16 | 10·251970 | 9·829669 | 5 23 | 10·170331 | 10·081639 | 5 7 | 9·918361 | 50 | 30 |
| 3 | 12 | 9·748123 | 6 19 | 10·251877 | 9·829805 | 6 27 | 10·170195 | 10·081682 | 6 9 | 9·918318 | 48 | 57 |
| 30 | 14 | 9·748216 | 7 22 | 10·251784 | 9·829941 | 7 32 | 10·170059 | 10·081724 | 7 10 | 9·918276 | 46 | 30 |
| 4 | 16 | 9·748310 | 8 25 | 10·251690 | 9·830077 | 8 36 | 10·169923 | 10·081767 | 8 11 | 9·918233 | 44 | 56 |
| 30 | 18 | 9·748403 | 9 28 | 10·251597 | 9·830213 | 9 41 | 10·169787 | 10·081810 | 9 13 | 9·918190 | 42 | 30 |
| 5 | 20 | 9·748497 | 10 31 | 10·251503 | 9·830349 | 10 45 | 10·169651 | 10·081853 | 10 14 | 9·918147 | 40 | 55 |
| 30 | 22 | 9·748590 | 11 34 | 10·251410 | 9·830485 | 11 50 | 10·169515 | 10·081895 | 11 16 | 9·918105 | 38 | 30 |
| 6 | 24 | 9·748683 | 12 37 | 10·251317 | 9·830621 | 12 54 | 10·169379 | 10·081938 | 12 17 | 9·918062 | 36 | 54 |
| 30 | 26 | 9·748777 | 13 40 | 10·251223 | 9·830757 | 13 59 | 10·169243 | 10·081981 | 13 19 | 9·918019 | 34 | 30 |
| 7 | 28 | 9·748870 | 14 43 | 10·251130 | 9·830893 | 14 63 | 10·169107 | 10·082024 | 14 20 | 9·917976 | 32 | 53 |
| 30 | 30 | 9·748963 | 15 47 | 10·251037 | 9·831029 | 15 68 | 10·168971 | 10·082066 | 15 21 | 9·917934 | 30 | 30 |
| 8 | 32 | 9·749056 | 16 50 | 10·250944 | 9·831165 | 16 72 | 10·168835 | 10·082109 | 16 23 | 9·917891 | 28 | 52 |
| 30 | 34 | 9·749149 | 17 53 | 10·250851 | 9·831301 | 17 77 | 10·168699 | 10·082152 | 17 24 | 9·917848 | 26 | 30 |
| 9 | 36 | 9·749243 | 18 56 | 10·250757 | 9·831437 | 18 82 | 10·168563 | 10·082195 | 18 26 | 9·917805 | 24 | 51 |
| 30 | 38 | 9·749336 | 19 59 | 10·250664 | 9·831573 | 19 86 | 10·168427 | 10·082238 | 19 27 | 9·917762 | 22 | 30 |
| 10 | 40 | 9·749429 | 20 62 | 10·250571 | 9·831709 | 20 91 | 10·168291 | 10·082281 | 20 29 | 9·917719 | 20 | 50 |
| 30 | 42 | 9·749522 | 21 65 | 10·250478 | 9·831845 | 21 95 | 10·168155 | 10·082324 | 21 30 | 9·917677 | 18 | 30 |
| 11 | 44 | 9·749615 | 22 68 | 10·250385 | 9·831981 | 22 100 | 10·168019 | 10·082366 | 22 31 | 9·917634 | 16 | 49 |
| 30 | 46 | 9·749708 | 23 72 | 10·250292 | 9·832117 | 23 104 | 10·167883 | 10·082409 | 23 33 | 9·917591 | 14 | 30 |
| 12 | 48 | 9·749801 | 24 75 | 10·250199 | 9·832253 | 24 109 | 10·167747 | 10·082452 | 24 34 | 9·917548 | 12 | 48 |
| 30 | 50 | 9·749894 | 25 78 | 10·250106 | 9·832389 | 25 113 | 10·167611 | 10·082495 | 25 36 | 9·917505 | 10 | 30 |
| 13 | 52 | 9·749987 | 26 81 | 10·250013 | 9·832525 | 26 118 | 10·167475 | 10·082538 | 26 37 | 9·917462 | 8 | 47 |
| 30 | 54 | 9·750079 | 27 84 | 10·249921 | 9·832660 | 27 122 | 10·167340 | 10·082581 | 27 39 | 9·917419 | 6 | 30 |
| 14 | 56 | 9·750172 | 28 87 | 10·249828 | 9·832796 | 28 127 | 10·167204 | 10·082624 | 28 40 | 9·917376 | 4 | 46 |
| 30 | 58 | 9·750265 | 29 90 | 10·249735 | 9·832932 | 29 131 | 10·167068 | 10·082667 | 29 41 | 9·917333 | 2 | 30 |
| 15 | **17** | 9·750358 | 30 93 | 10·249642 | 9·833068 | 30 136 | 10·166932 | 10·082710 | 30 43 | 9·917290 | **43** | 45 |
| 30 | 2 | 9·750451 | 1 3 | 10·249549 | 9·833204 | 1 5 | 10·166796 | 10·082753 | 1 1 | 9·917247 | 58 | 30 |
| 16 | 4 | 9·750543 | 2 6 | 10·249457 | 9·833339 | 2 9 | 10·166661 | 10·082796 | 2 3 | 9·917204 | 56 | 44 |
| 30 | 6 | 9·750636 | 3 9 | 10·249364 | 9·833475 | 3 14 | 10·166525 | 10·082839 | 3 4 | 9·917161 | 54 | 30 |
| 17 | 8 | 9·750729 | 4 12 | 10·249271 | 9·833611 | 4 18 | 10·166389 | 10·082882 | 4 6 | 9·917118 | 52 | 43 |
| 30 | 10 | 9·750821 | 5 15 | 10·249179 | 9·833747 | 5 23 | 10·166253 | 10·082925 | 5 7 | 9·917075 | 50 | 30 |
| 18 | 12 | 9·750914 | 6 18 | 10·249086 | 9·833882 | 6 27 | 10·166118 | 10·082968 | 6 9 | 9·917032 | 48 | 42 |
| 30 | 14 | 9·751007 | 7 21 | 10·248993 | 9·834018 | 7 32 | 10·165982 | 10·083011 | 7 10 | 9·916989 | 46 | 30 |
| 19 | 16 | 9·751099 | 8 25 | 10·248901 | 9·834154 | 8 36 | 10·165846 | 10·083054 | 8 12 | 9·916946 | 44 | 41 |
| 30 | 18 | 9·751192 | 9 28 | 10·248808 | 9·834289 | 9 41 | 10·165711 | 10·083098 | 9 13 | 9·916902 | 42 | 30 |
| 20 | 20 | 9·751284 | 10 31 | 10·248716 | 9·834425 | 10 45 | 10·165575 | 10·083141 | 10 14 | 9·916859 | 40 | 40 |
| 30 | 22 | 9·751377 | 11 34 | 10·248623 | 9·834561 | 11 50 | 10·165440 | 10·083184 | 11 16 | 9·916816 | 38 | 30 |
| 21 | 24 | 9·751469 | 12 37 | 10·248531 | 9·834696 | 12 54 | 10·165304 | 10·083227 | 12 17 | 9·916773 | 36 | 39 |
| 30 | 26 | 9·751561 | 13 40 | 10·248439 | 9·834832 | 13 59 | 10·165168 | 10·083270 | 13 19 | 9·916730 | 34 | 30 |
| 22 | 28 | 9·751654 | 14 43 | 10·248346 | 9·834967 | 14 63 | 10·165033 | 10·083313 | 14 20 | 9·916687 | 32 | 38 |
| 30 | 30 | 9·751746 | 15 46 | 10·248254 | 9·835103 | 15 68 | 10·164897 | 10·083357 | 15 22 | 9·916643 | 30 | 30 |
| 23 | 32 | 9·751839 | 16 49 | 10·248161 | 9·835238 | 16 72 | 10·164762 | 10·083400 | 16 23 | 9·916600 | 28 | 37 |
| 30 | 34 | 9·751931 | 17 52 | 10·248069 | 9·835374 | 17 77 | 10·164626 | 10·083443 | 17 24 | 9·916557 | 26 | 30 |
| 24 | 36 | 9·752023 | 18 55 | 10·247977 | 9·835509 | 18 81 | 10·164491 | 10·083486 | 18 26 | 9·916514 | 24 | 36 |
| 30 | 38 | 9·752115 | 19 59 | 10·247885 | 9·835645 | 19 86 | 10·164355 | 10·083530 | 19 27 | 9·916470 | 22 | 30 |
| 25 | 40 | 9·752208 | 20 62 | 10·247792 | 9·835780 | 20 90 | 10·164220 | 10·083573 | 20 29 | 9·916427 | 20 | 35 |
| 30 | 42 | 9·752300 | 21 65 | 10·247700 | 9·835916 | 21 95 | 10·164084 | 10·083616 | 21 30 | 9·916384 | 18 | 30 |
| 26 | 44 | 9·752392 | 22 68 | 10·247608 | 9·836051 | 22 99 | 10·163949 | 10·083659 | 22 32 | 9·916341 | 16 | 34 |
| 30 | 46 | 9·752484 | 23 71 | 10·247516 | 9·836187 | 23 104 | 10·163813 | 10·083703 | 23 33 | 9·916297 | 14 | 30 |
| 27 | 48 | 9·752576 | 24 74 | 10·247424 | 9·836322 | 24 108 | 10·163678 | 10·083746 | 24 35 | 9·916254 | 12 | 33 |
| 30 | 50 | 9·752668 | 25 77 | 10·247332 | 9·836458 | 25 113 | 10·163542 | 10·083789 | 25 36 | 9·916211 | 10 | 30 |
| 28 | 52 | 9·752760 | 26 80 | 10·247240 | 9·836593 | 26 118 | 10·163407 | 10·083833 | 26 37 | 9·916167 | 8 | 32 |
| 30 | 54 | 9·752852 | 27 83 | 10·247148 | 9·836728 | 27 122 | 10·163272 | 10·083876 | 27 39 | 9·916124 | 6 | 30 |
| 29 | 56 | 9·752944 | 28 86 | 10·247056 | 9·836864 | 28 127 | 10·163136 | 10·083920 | 28 40 | 9·916081 | 4 | 31 |
| 30 | 58 | 9·753036 | 29 89 | 10·246964 | 9·836999 | 29 131 | 10·163001 | 10·083963 | 29 42 | 9·916037 | 2 | 30 |
| 30 | **18** | 9·753128 | 30 92 | 10·246872 | 9·837134 | 30 136 | 10·162866 | 10·084006 | 30 43 | 9·915994 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | | 55° | | | | 3h 42m | | |

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

| 2h 18m | | | | | 34° | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 30 | 0 | 9·753128 | | 10·246872 | 9·837134 | | 10·162866 | 10·084006 | | 9·915994 | 42 | 30 |
| 30 | 2 | 9·753220 | 1″ 3 | 10·246780 | 9·837270 | 1″ 4 | 10·162730 | 10·084050 | 1″ 1 | 9·915950 | 58 | 30 |
| 31 | 4 | 9·753312 | 2 6 | 10·246688 | 9·837405 | 2 9 | 10·162595 | 10·084093 | 2 3 | 9·915907 | 56 | 29 |
| 30 | 6 | 9·753404 | 3 9 | 10 246596 | 9·837540 | 3 13 | 10·162460 | 10·084137 | 3 4 | 9·915863 | 54 | 30 |
| 32 | 8 | 9·753495 | 4 12 | 10·246505 | 9·837675 | 4 18 | 10·162325 | 10·084180 | 4 6 | 9·915820 | 52 | 28 |
| 30 | 10 | 9·753587 | 5 15 | 10·246413 | 9·837811 | 5 22 | 10·162189 | 10·084224 | 5 7 | 9·915776 | 50 | 30 |
| 33 | 12 | 9·753679 | 6 18 | 10·246321 | 9·837946 | 6 27 | 10·162054 | 10·084267 | 6 9 | 9·915733 | 48 | 27 |
| 30 | 14 | 9·753771 | 7 21 | 10·246229 | 9·838081 | 7 31 | 10·161919 | 10·084311 | 7 10 | 9·915689 | 46 | 30 |
| 34 | 16 | 9·753862 | 8 24 | 10·246138 | 9·838216 | 8 36 | 10·161784 | 10·084354 | 8 12 | 9·915646 | 44 | 26 |
| 30 | 18 | 9·753954 | 9 27 | 10·246046 | 9·838352 | 9 40 | 10·161648 | 10·084398 | 9 13 | 9·915602 | 42 | 30 |
| 35 | 20 | 9·754046 | 10 30 | 10·245954 | 9·838487 | 10 45 | 10·161513 | 10·084441 | 10 15 | 9·915559 | 40 | 25 |
| 30 | 22 | 9·754137 | 11 34 | 10·245863 | 9·838622 | 11 49 | 10·161378 | 10·084485 | 11 16 | 9·915515 | 38 | 30 |
| 36 | 24 | 9·754229 | 12 37 | 10·245771 | 9·838757 | 12 54 | 10·161243 | 10·084528 | 12 17 | 9·915472 | 36 | 24 |
| 30 | 26 | 9·754320 | 13 40 | 10·245680 | 9·838892 | 13 58 | 10·161108 | 10·084572 | 13 19 | 9·915428 | 34 | 30 |
| 37 | 28 | 9·754412 | 14 43 | 10·245588 | 9·839027 | 14 63 | 10·160973 | 10·084615 | 14 20 | 9·915385 | 32 | 23 |
| 30 | 30 | 9·754503 | 15 46 | 10·245497 | 9·839162 | 15 67 | 10·160838 | 10·084659 | 15 22 | 9·915341 | 30 | 30 |
| 38 | 32 | 9·754595 | 16 49 | 10·245405 | 9·839297 | 16 72 | 10·160703 | 10·084703 | 16 23 | 9·915297 | 28 | 22 |
| 30 | 34 | 9·754686 | 17 52 | 10·245314 | 9·839433 | 17 76 | 10·160567 | 10·084746 | 17 25 | 9·915254 | 26 | 30 |
| 39 | 36 | 9·754778 | 18 55 | 10·245222 | 9·839568 | 18 81 | 10·160432 | 10·084790 | 18 26 | 9·915210 | 24 | 21 |
| 30 | 38 | 9·754869 | 19 58 | 10·245131 | 9·839703 | 19 85 | 10·160297 | 10·084834 | 19 28 | 9·915166 | 22 | 30 |
| 40 | 40 | 9·754960 | 20 61 | 10·245040 | 9·839838 | 20 90 | 10·160162 | 10·084877 | 20 29 | 9·915123 | 20 | 20 |
| 30 | 42 | 9·755052 | 21 64 | 10·244948 | 9·839973 | 21 94 | 10·160027 | 10·084921 | 21 30 | 9·915079 | 18 | 30 |
| 41 | 44 | 9·755143 | 22 67 | 10·244857 | 9·840108 | 22 99 | 10·159892 | 10·084965 | 22 32 | 9·915035 | 16 | 19 |
| 30 | 46 | 9·755234 | 23 70 | 10·244766 | 9·840243 | 23 103 | 10·159757 | 10·085008 | 23 33 | 9·914992 | 14 | 30 |
| 42 | 48 | 9·755326 | 24 73 | 10·244674 | 9·840378 | 24 108 | 10·159622 | 10·085052 | 24 35 | 9·914948 | 12 | 18 |
| 30 | 50 | 9·755417 | 25 76 | 10·244583 | 9·840513 | 25 112 | 10·159487 | 10·085096 | 25 36 | 9·914904 | 10 | 30 |
| 43 | 52 | 9·755508 | 26 79 | 10·244492 | 9·840648 | 26 117 | 10·159352 | 10·085140 | 26 38 | 9·914860 | 8 | 17 |
| 30 | 54 | 9·755599 | 27 82 | 10·244401 | 9·840782 | 27 121 | 10·159218 | 10·085183 | 27 39 | 9·914817 | 6 | 30 |
| 44 | 56 | 9·755690 | 28 85 | 10·244310 | 9·840917 | 28 126 | 10·159083 | 10·085227 | 28 40 | 9·914773 | 4 | 16 |
| 30 | 58 | 9·755781 | 29 88 | 10·244219 | 9·841052 | 29 130 | 10·158948 | 10·085271 | 29 42 | 9·914729 | 2 | 30 |
| 45 | **19** | 9·755872 | 30 91 | 10·244128 | 9·841187 | 30 135 | 10·158813 | 10·085315 | 30 44 | 9·914685 | **41** | 15 |
| 30 | 2 | 9·755963 | 1 3 | 10·244037 | 9·841322 | 1 4 | 10·158678 | 10·085359 | 1 1 | 9·914641 | 58 | 30 |
| 46 | 4 | 9·756054 | 2 6 | 10·243946 | 9·841457 | 2 9 | 10·158543 | 10·085402 | 2 3 | 9·914598 | 56 | 14 |
| 30 | 6 | 9·756145 | 3 9 | 10·243855 | 9·841592 | 3 13 | 10·158408 | 10·085446 | 8 4 | 9·914554 | 54 | 30 |
| 47 | 8 | 9·756236 | 4 12 | 10·243764 | 9·841727 | 4 18 | 10·158273 | 10·085490 | 4 6 | 9·914510 | 52 | 13 |
| 30 | 10 | 9·756327 | 5 15 | 10·243673 | 9·841861 | 5 22 | 10·158139 | 10·085534 | 5 7 | 9·914466 | 50 | 30 |
| 48 | 12 | 9·756418 | 6 18 | 10·243582 | 9·841996 | 6 27 | 10·158004 | 10·085578 | 6 9 | 9·914422 | 48 | 12 |
| 30 | 14 | 9·756509 | 7 21 | 10·243491 | 9·842131 | 7 31 | 10·157869 | 10·085622 | 7 10 | 9·914378 | 46 | 30 |
| 49 | 16 | 9·756600 | 8 24 | 10·243400 | 9·842266 | 8 36 | 10·157734 | 10·085666 | 8 12 | 9·914334 | 44 | 11 |
| 30 | 18 | 9·756691 | 9 27 | 10·243309 | 9·842400 | 9 40 | 10·157600 | 10·085710 | 9 13 | 9·914290 | 42 | 30 |
| 50 | 20 | 9·756782 | 10 30 | 10·243218 | 9·842535 | 10 45 | 10·157465 | 10·085754 | 10 15 | 9·914246 | 40 | 10 |
| 30 | 22 | 9·756872 | 11 33 | 10·243128 | 9·842670 | 11 49 | 10·157330 | 10·085798 | 11 16 | 9·914202 | 38 | 30 |
| 51 | 24 | 9·756963 | 12 36 | 10·243037 | 9·842805 | 12 54 | 10·157195 | 10·085842 | 12 18 | 9·914158 | 36 | 9 |
| 30 | 26 | 9·757054 | 13 39 | 10·242946 | 9·842939 | 13 58 | 10·157061 | 10·085886 | 13 19 | 9·914114 | 34 | 30 |
| 52 | 28 | 9·757144 | 14 42 | 10·242856 | 9·843074 | 14 63 | 10·156926 | 10·085930 | 14 21 | 9·914070 | 32 | 8 |
| 30 | 30 | 9·757235 | 15 45 | 10·242765 | 9·843209 | 15 67 | 10·156791 | 10·085974 | 15 22 | 9·914026 | 30 | 30 |
| 53 | 32 | 9·757326 | 16 48 | 10·242674 | 9·843343 | 16 72 | 10·156657 | 10·086018 | 16 24 | 9·913982 | 28 | 7 |
| 30 | 34 | 9·757416 | 17 51 | 10·242584 | 9·843478 | 17 76 | 10·156522 | 10·086062 | 17 25 | 9·913938 | 26 | 30 |
| 54 | 36 | 9·757507 | 18 54 | 10·242493 | 9·843612 | 18 81 | 10·156388 | 10·086106 | 18 26 | 9·913894 | 24 | 6 |
| 30 | 38 | 9·757597 | 19 57 | 10·242403 | 9·843747 | 19 85 | 10·156253 | 10·086150 | 19 28 | 9·913850 | 22 | 30 |
| 55 | 40 | 9·757688 | 20 60 | 10·242312 | 9·843882 | 20 90 | 10·156118 | 10·086194 | 20 29 | 9·913806 | 20 | 5 |
| 30 | 42 | 9·757778 | 21 63 | 10·242222 | 9·844016 | 21 94 | 10·155984 | 10·086238 | 21 31 | 9·913762 | 18 | 30 |
| 56 | 44 | 9·757869 | 22 66 | 10·242131 | 9·844151 | 22 99 | 10·155849 | 10·086282 | 22 32 | 9·913718 | 16 | 4 |
| 30 | 46 | 9·757959 | 23 69 | 10·242041 | 9·844285 | 23 103 | 10·155715 | 10·086326 | 23 34 | 9·913674 | 14 | 30 |
| 57 | 48 | 9·758050 | 24 72 | 10·241950 | 9·844420 | 24 108 | 10·155580 | 10·086370 | 24 35 | 9·913630 | 12 | 3 |
| 30 | 50 | 9·758140 | 25 76 | 10·241860 | 9·844554 | 25 112 | 10·155446 | 10·086415 | 25 37 | 9·913585 | 10 | 30 |
| 58 | 52 | 9·758230 | 26 79 | 10·241770 | 9·844689 | 26 117 | 10·155311 | 10·086459 | 26 38 | 9·913541 | 8 | 2 |
| 30 | 54 | 9·758321 | 27 82 | 10·241679 | 9·844823 | 27 121 | 10·155177 | 10·086503 | 27 40 | 9·913497 | 6 | 30 |
| 59 | 56 | 9·758411 | 28 85 | 10·241589 | 9·844958 | 28 126 | 10·155042 | 10·086547 | 28 41 | 9·913453 | 4 | 1 |
| 30 | 58 | 9·758501 | 29 88 | 10·241499 | 9·845092 | 29 130 | 10·154908 | 10·086591 | 29 43 | 9·913409 | 2 | 30 |
| 60 | **20** | 9·758591 | 30 91 | 10·241409 | 9·845227 | 30 135 | 10·154773 | 10·086635 | 30 44 | 9·913365 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | 55° | | | | | 3h 40m | | |

TABLE XXVI.—(*continued*).

## LOG. SINES, COSINES, &c.

$2^h\ 20^m$ 35°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·758591 | | 10·241409 | 9·845227 | | 10·154773 | 10·086635 | | 9·913365 | 40 | 60 |
| 30 | 2 | 9·758681 | 1″ 3 | 10·241319 | 9·845361 | 1″ 4 | 10·154639 | 10·086680 | 1″ 1 | 9·913320 | 58 | 30 |
| 1 | 4 | 9·758772 | 2 6 | 10·241228 | 9·845496 | 2 9 | 10·154504 | 10·086724 | 2 3 | 9·913276 | 56 | 59 |
| 30 | 6 | 9·758862 | 3 9 | 10·241138 | 9·845630 | 3 13 | 10·154370 | 10·086768 | 3 4 | 9·913232 | 54 | 30 |
| 2 | 8 | 9·758952 | 4 12 | 10·241048 | 9·845764 | 4 18 | 10·154236 | 10·086813 | 4 6 | 9·913187 | 52 | 58 |
| 30 | 10 | 9·759042 | 5 15 | 10·240958 | 9·845899 | 5 22 | 10·154101 | 10·086857 | 5 7 | 9·913143 | 50 | 30 |
| 3 | 12 | 9·759132 | 6 18 | 10·240868 | 9·846033 | 6 27 | 10·153967 | 10·086901 | 6 9 | 9·913099 | 48 | 57 |
| 30 | 14 | 9·759222 | 7 21 | 10·240778 | 9·846168 | 7 31 | 10·153832 | 10·086945 | 7 10 | 9·913055 | 46 | 30 |
| 4 | 16 | 9·759312 | 8 24 | 10·240688 | 9·846302 | 8 36 | 10·153698 | 10·086990 | 8 12 | 9·913010 | 44 | 56 |
| 30 | 18 | 9·759402 | 9 27 | 10·240598 | 9·846436 | 9 40 | 10·153564 | 10·087034 | 9 13 | 9·912966 | 42 | 30 |
| 5 | 20 | 9·759492 | 10 30 | 10·240508 | 9·846570 | 10 45 | 10·153430 | 10·087078 | 10 15 | 9·912922 | 40 | 55 |
| 30 | 22 | 9·759582 | 11 33 | 10·240418 | 9·846705 | 11 49 | 10·153295 | 10·087123 | 11 16 | 9·912877 | 38 | 30 |
| 6 | 24 | 9·759672 | 12 36 | 10·240328 | 9·846839 | 12 54 | 10·153161 | 10·087167 | 12 18 | 9·912833 | 36 | 54 |
| 30 | 26 | 9·759762 | 13 39 | 10·240238 | 9·846973 | 13 58 | 10·153027 | 10·087212 | 13 19 | 9·912788 | 34 | 30 |
| 7 | 28 | 9·759852 | 14 42 | 10·240148 | 9·847108 | 14 63 | 10·152892 | 10·087256 | 14 21 | 9·912744 | 32 | 53 |
| 30 | 30 | 9·759941 | 15 45 | 10·240059 | 9·847242 | 15 67 | 10·152758 | 10·087300 | 15 22 | 9·912700 | 30 | 30 |
| 8 | 32 | 9·760031 | 16 48 | 10·239969 | 9·847376 | 16 72 | 10·152624 | 10·087345 | 16 24 | 9·912655 | 28 | 52 |
| 30 | 34 | 9·760121 | 17 51 | 10·239879 | 9·847510 | 17 76 | 10·152490 | 10·087389 | 17 25 | 9·912611 | 26 | 30 |
| 9 | 36 | 9·760211 | 18 54 | 10·239789 | 9·847644 | 18 80 | 10·152356 | 10·087434 | 18 27 | 9·912566 | 24 | 51 |
| 30 | 38 | 9·760300 | 19 57 | 10·239700 | 9·847779 | 19 85 | 10·152221 | 10·087478 | 19 28 | 9·912522 | 22 | 30 |
| 10 | 40 | 9·760390 | 20 60 | 10·239610 | 9·847913 | 20 89 | 10·152087 | 10·087523 | 20 30 | 9·912477 | 20 | 50 |
| 30 | 42 | 9·760480 | 21 63 | 10·239520 | 9·848047 | 21 94 | 10·151953 | 10·087567 | 21 31 | 9·912433 | 18 | 30 |
| 11 | 44 | 9·760569 | 22 66 | 10·239431 | 9·848181 | 22 98 | 10·151819 | 10·087612 | 22 33 | 9·912388 | 16 | 49 |
| 30 | 46 | 9·760659 | 23 69 | 10·239341 | 9·848315 | 23 103 | 10·151685 | 10·087656 | 23 34 | 9·912344 | 14 | 30 |
| 12 | 48 | 9·760748 | 24 72 | 10·239252 | 9·848449 | 24 107 | 10·151551 | 10·087701 | 24 36 | 9·912299 | 12 | 48 |
| 30 | 50 | 9·760838 | 25 75 | 10·239162 | 9·848583 | 25 112 | 10·151417 | 10·087746 | 25 37 | 9·912255 | 10 | 30 |
| 13 | 52 | 9·760927 | 26 78 | 10·239073 | 9·848717 | 26 116 | 10·151283 | 10·087790 | 26 38 | 9·912210 | 8 | 47 |
| 30 | 54 | 9·761017 | 27 81 | 10·238983 | 9·848851 | 27 121 | 10·151149 | 10·087835 | 27 40 | 9·912165 | 6 | 30 |
| 14 | 56 | 9·761106 | 28 84 | 10·238894 | 9·848986 | 28 125 | 10·151014 | 10·087879 | 28 41 | 9·912121 | 4 | 46 |
| 30 | 58 | 9·761196 | 29 87 | 10·238804 | 9·849120 | 29 130 | 10·150880 | 10·087924 | 29 43 | 9·912076 | 2 | 30 |
| 15 | **21** | 9·761285 | 30 90 | 10·238715 | 9·849254 | 30 134 | 10·150746 | 10·087969 | 30 44 | 9·912031 | **39** | 45 |
| 30 | 2 | 9·761374 | 1 3 | 10·238626 | 9·849388 | 1 4 | 10·150612 | 10·088013 | 1 1 | 9·911987 | 58 | 30 |
| 16 | 4 | 9·761464 | 2 6 | 10·238536 | 9·849522 | 2 9 | 10·150478 | 10·088058 | 2 3 | 9·911942 | 56 | 44 |
| 30 | 6 | 9·761553 | 3 9 | 10·238447 | 9·849656 | 3 13 | 10·150344 | 10·088103 | 3 4 | 9·911897 | 54 | 30 |
| 17 | 8 | 9·761642 | 4 12 | 10·238358 | 9·849790 | 4 18 | 10·150210 | 10·088147 | 4 6 | 9·911853 | 52 | 43 |
| 30 | 10 | 9·761732 | 5 15 | 10·238268 | 9·849924 | 5 22 | 10·150076 | 10·088192 | 5 7 | 9·911808 | 50 | 30 |
| 18 | 12 | 9·761821 | 6 18 | 10·238179 | 9·850057 | 6 27 | 10·149943 | 10·088237 | 6 9 | 9·911763 | 48 | 42 |
| 30 | 14 | 9·761910 | 7 21 | 10·238090 | 9·850191 | 7 31 | 10·149809 | 10·088281 | 7 10 | 9·911719 | 46 | 30 |
| 19 | 16 | 9·761999 | 8 24 | 10·238001 | 9·850325 | 8 36 | 10·149675 | 10·088326 | 8 12 | 9·911674 | 44 | 41 |
| 30 | 18 | 9·762088 | 9 27 | 10·237912 | 9·850459 | 9 40 | 10·149541 | 10·088371 | 9 13 | 9·911629 | 42 | 30 |
| 20 | 20 | 9·762177 | 10 30 | 10·237823 | 9·850593 | 10 45 | 10·149407 | 10·088416 | 10 15 | 9·911584 | 40 | 40 |
| 30 | 22 | 9·762267 | 11 33 | 10·237733 | 9·850727 | 11 49 | 10·149273 | 10·088460 | 11 16 | 9·911540 | 38 | 30 |
| 21 | 24 | 9·762356 | 12 36 | 10·237644 | 9·850861 | 12 54 | 10·149139 | 10·088505 | 12 18 | 9·911495 | 36 | 39 |
| 30 | 26 | 9·762445 | 13 38 | 10·237555 | 9·850995 | 13 58 | 10·149005 | 10·088550 | 13 19 | 9·911450 | 34 | 30 |
| 22 | 28 | 9·762534 | 14 41 | 10·237466 | 9·851129 | 14 62 | 10·148871 | 10·088595 | 14 21 | 9·911405 | 32 | 38 |
| 30 | 30 | 9·762623 | 15 44 | 10·237377 | 9·851262 | 15 67 | 10·148738 | 10·088640 | 15 22 | 9·911360 | 30 | 30 |
| 23 | 32 | 9·762712 | 16 47 | 10·237288 | 9·851396 | 16 71 | 10·148604 | 10·088685 | 16 24 | 9·911315 | 28 | 37 |
| 30 | 34 | 9·762801 | 17 50 | 10·237199 | 9·851530 | 17 76 | 10·148470 | 10·088729 | 17 25 | 9·911271 | 26 | 30 |
| 24 | 36 | 9·762889 | 18 53 | 10·237111 | 9·851664 | 18 80 | 10·148336 | 10·088774 | 18 27 | 9·911226 | 24 | 36 |
| 30 | 38 | 9·762978 | 19 56 | 10·237022 | 9·851797 | 19 85 | 10·148203 | 10·088819 | 19 28 | 9·911181 | 22 | 30 |
| 25 | 40 | 9·763067 | 20 59 | 10·236933 | 9·851931 | 20 89 | 10·148069 | 10·088864 | 20 30 | 9·911136 | 20 | 35 |
| 30 | 42 | 9·763156 | 21 62 | 10·236844 | 9·852065 | 21 94 | 10·147935 | 10·088909 | 21 31 | 9·911091 | 18 | 30 |
| 26 | 44 | 9·763245 | 22 65 | 10·236755 | 9·852199 | 22 98 | 10·147801 | 10·088954 | 22 33 | 9·911046 | 16 | 34 |
| 30 | 46 | 9·763333 | 23 68 | 10·236667 | 9·852332 | 23 103 | 10·147668 | 10·088999 | 23 34 | 9·911001 | 14 | 30 |
| 27 | 48 | 9·763422 | 24 71 | 10·236578 | 9·852466 | 24 107 | 10·147534 | 10·089044 | 24 36 | 9·910956 | 12 | 33 |
| 30 | 50 | 9·763511 | 25 74 | 10·236489 | 9·852600 | 25 111 | 10·147400 | 10·089089 | 25 37 | 9·910911 | 10 | 30 |
| 28 | 52 | 9·763600 | 26 77 | 10·236400 | 9·852733 | 26 116 | 10·147267 | 10·089134 | 26 39 | 9·910866 | 8 | 32 |
| 30 | 54 | 9·763688 | 27 80 | 10·236312 | 9·852867 | 27 120 | 10·147133 | 10·089179 | 27 40 | 9·910821 | 6 | 30 |
| 29 | 56 | 9·763777 | 28 83 | 10·236223 | 9·853001 | 28 125 | 10·146999 | 10·089224 | 28 42 | 9·910776 | 4 | 31 |
| 30 | 58 | 9·763865 | 29 86 | 10·236135 | 9·853134 | 29 129 | 10·146866 | 10·089269 | 29 43 | 9·910731 | 2 | 30 |
| 30 | **22** | 9·763954 | 30 89 | 10·236046 | 9·853268 | 30 134 | 10·146732 | 10·089314 | 30 45 | 9·910686 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

54° $3^h\ 38^m$

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

| $2^h\ 22^m$ | | | | | 35° | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 30 | 0 | 9·763954 | | 10·236046 | 9·853268 | | 10·146732 | 10·089314 | | 9·910686 | 38 | 30 |
| 30 | 2 | 9·764043 | 1″ 3 | 10·235957 | 9·853402 | 1″ 4 | 10·146598 | 10·089359 | 1″ 2 | 9·910641 | 58 | 30 |
| 31 | 4 | 9·764131 | 2 6 | 10·235869 | 9·853535 | 2 9 | 10·146465 | 10·089404 | 2 3 | 9·910596 | 56 | 29 |
| 30 | 6 | 9·764220 | 3 9 | 10·235780 | 9·853669 | 3 13 | 10·146331 | 10·089449 | 3 5 | 9·910551 | 54 | 30 |
| 32 | 8 | 9·764308 | 4 12 | 10·235692 | 9·853802 | 4 18 | 10·146198 | 10·089494 | 4 6 | 9·910506 | 52 | 28 |
| 30 | 10 | 9·764396 | 5 15 | 10·235604 | 9·853936 | 5 22 | 10·146064 | 10·089539 | 5 8 | 9·910461 | 50 | 30 |
| 33 | 12 | 9·764485 | 6 18 | 10·235515 | 9·854069 | 6 27 | 10·145931 | 10·089585 | 6 9 | 9·910415 | 48 | 27 |
| 30 | 14 | 9·764573 | 7 21 | 10·235427 | 9·854203 | 7 31 | 10·145797 | 10·089630 | 7 11 | 9·910370 | 46 | 30 |
| 34 | 16 | 9·764662 | 8 24 | 10·235338 | 9·854336 | 8 36 | 10·145664 | 10·089675 | 8 12 | 9·910325 | 44 | 26 |
| 30 | 18 | 9·764750 | 9 26 | 10·235250 | 9·854470 | 9 40 | 10·145530 | 10·089720 | 9 14 | 9·910280 | 42 | 30 |
| 35 | 20 | 9·764838 | 10 29 | 10·235162 | 9·854603 | 10 44 | 10·145397 | 10·089765 | 10 15 | 9·910235 | 40 | 25 |
| 30 | 22 | 9·764926 | 11 32 | 10·235074 | 9·854737 | 11 49 | 10·145263 | 10·089810 | 11 17 | 9·910190 | 38 | 30 |
| 36 | 24 | 9·765015 | 12 35 | 10·234985 | 9·854870 | 12 53 | 10·145130 | 10·089856 | 12 18 | 9·910144 | 36 | 24 |
| 30 | 26 | 9·765103 | 13 38 | 10·234897 | 9·855004 | 13 58 | 10·144996 | 10·089901 | 13 20 | 9·910099 | 34 | 30 |
| 37 | 28 | 9·765191 | 14 41 | 10·234809 | 9·855137 | 14 62 | 10·144863 | 10·089946 | 14 21 | 9·910054 | 32 | 23 |
| 30 | 30 | 9·765279 | 15 44 | 10·234721 | 9·855271 | 15 67 | 10·144729 | 10·089991 | 15 23 | 9·910009 | 30 | 30 |
| 38 | 32 | 9·765367 | 16 47 | 10·234633 | 9·855404 | 16 71 | 10·144596 | 10·090037 | 16 24 | 9·909963 | 28 | 22 |
| 30 | 34 | 9·765456 | 17 50 | 10·234544 | 9·855537 | 17 76 | 10·144463 | 10·090082 | 17 26 | 9·909918 | 26 | 30 |
| 39 | 36 | 9·765544 | 18 53 | 10·234456 | 9·855671 | 18 80 | 10·144329 | 10·090127 | 18 27 | 9·909873 | 24 | 21 |
| 30 | 38 | 9·765632 | 19 56 | 10·234368 | 9·855804 | 19 85 | 10·144196 | 10·090173 | 19 29 | 9·909827 | 22 | 30 |
| 40 | 40 | 9·765720 | 20 59 | 10·234280 | 9·855938 | 20 89 | 10·144062 | 10·090218 | 20 30 | 9·909782 | 20 | 20 |
| 30 | 42 | 9·765808 | 21 62 | 10·234192 | 9·856071 | 21 93 | 10·143929 | 10·090263 | 21 32 | 9·909737 | 18 | 30 |
| 41 | 44 | 9·765896 | 22 65 | 10·234104 | 9·856204 | 22 98 | 10·143796 | 10·090309 | 22 33 | 9·909691 | 16 | 19 |
| 30 | 46 | 9·765984 | 23 68 | 10·234016 | 9·856338 | 23 102 | 10·143662 | 10·090354 | 23 35 | 9·909646 | 14 | 30 |
| 42 | 48 | 9·766072 | 24 71 | 10·233928 | 9·856471 | 24 107 | 10·143529 | 10·090399 | 24 36 | 9·909601 | 12 | 18 |
| 30 | 50 | 9·766159 | 25 74 | 10·233841 | 9·856604 | 25 111 | 10·143396 | 10·090445 | 25 38 | 9·909555 | 10 | 30 |
| 43 | 52 | 9·766247 | 26 76 | 10·233753 | 9·856737 | 26 116 | 10·143263 | 10·090490 | 26 39 | 9·909510 | 8 | 17 |
| 30 | 54 | 9·766335 | 27 79 | 10·233665 | 9·856871 | 27 120 | 10·143129 | 10·090536 | 27 41 | 9·909464 | 6 | 30 |
| 44 | 56 | 9·766423 | 28 82 | 10·233577 | 9·857004 | 28 125 | 10·142996 | 10·090581 | 28 42 | 9·909419 | 4 | 16 |
| 30 | 58 | 9·766511 | 29 85 | 10·233489 | 9·857137 | 29 129 | 10·142863 | 10·090626 | 29 44 | 9·909374 | 2 | 30 |
| 45 | **23** | 9·766598 | 30 88 | 10·233402 | 9·857270 | 30 133 | 10·142730 | 10·090672 | 30 45 | 9·909328 | **37** | 15 |
| 30 | 2 | 9·766686 | 1 3 | 10·233314 | 9·857404 | 1 4 | 10·142596 | 10·090717 | 1 2 | 9·909283 | 58 | 30 |
| 46 | 4 | 9·766774 | 2 6 | 10·233226 | 9·857537 | 2 9 | 10·142463 | 10·090763 | 2 3 | 9·909237 | 56 | 14 |
| 30 | 6 | 9·766862 | 3 9 | 10·233138 | 9·857670 | 3 13 | 10·142330 | 10·090808 | 3 5 | 9·909192 | 54 | 30 |
| 47 | 8 | 9·766949 | 4 12 | 10·233051 | 9·857803 | 4 18 | 10·142197 | 10·090854 | 4 6 | 9·909146 | 52 | 13 |
| 30 | 10 | 9·767037 | 5 15 | 10·232963 | 9·857936 | 5 22 | 10·142064 | 10·090899 | 5 8 | 9·909101 | 50 | 30 |
| 48 | 12 | 9·767124 | 6 17 | 10·232876 | 9·858069 | 6 27 | 10·141931 | 10·090945 | 6 9 | 9·909055 | 48 | 12 |
| 30 | 14 | 9·767212 | 7 20 | 10·232788 | 9·858203 | 7 31 | 10·141797 | 10·090991 | 7 11 | 9·909009 | 46 | 30 |
| 49 | 16 | 9·767300 | 8 23 | 10·232700 | 9·858336 | 8 35 | 10·141664 | 10·091036 | 8 12 | 9·908964 | 44 | 11 |
| 30 | 18 | 9·767387 | 9 26 | 10·232613 | 9·858469 | 9 40 | 10·141531 | 10·091082 | 9 14 | 9·908918 | 42 | 30 |
| 50 | 20 | 9·767475 | 10 29 | 10·232525 | 9·858602 | 10 44 | 10·141398 | 10·091127 | 10 15 | 9·908873 | 40 | 10 |
| 30 | 22 | 9·767562 | 11 32 | 10·232438 | 9·858735 | 11 49 | 10·141265 | 10·091173 | 11 17 | 9·908827 | 38 | 30 |
| 51 | 24 | 9·767649 | 12 35 | 10·232351 | 9·858868 | 12 53 | 10·141132 | 10·091219 | 12 18 | 9·908781 | 36 | 9 |
| 30 | 26 | 9·767737 | 13 38 | 10·232263 | 9·859001 | 13 58 | 10·140999 | 10·091264 | 13 20 | 9·908736 | 34 | 30 |
| 52 | 28 | 9·767824 | 14 41 | 10·232176 | 9·859134 | 14 62 | 10·140866 | 10·091310 | 14 21 | 9·908690 | 32 | 8 |
| 30 | 30 | 9·767912 | 15 44 | 10·232088 | 9·859267 | 15 66 | 10·140733 | 10·091356 | 15 23 | 9·908644 | 30 | 30 |
| 53 | 32 | 9·767999 | 16 47 | 10·232001 | 9·859400 | 16 71 | 10·140600 | 10·091401 | 16 24 | 9·908599 | 28 | 7 |
| 30 | 34 | 9·768086 | 17 49 | 10·231914 | 9·859533 | 17 75 | 10·140467 | 10·091447 | 17 26 | 9·908553 | 26 | 30 |
| 54 | 36 | 9·768173 | 18 52 | 10·231827 | 9·859666 | 18 80 | 10·140334 | 10·091493 | 18 27 | 9·908507 | 24 | 6 |
| 30 | 38 | 9·768261 | 19 55 | 10·231739 | 9·859799 | 19 84 | 10·140201 | 10·091538 | 19 29 | 9·908462 | 22 | 30 |
| 55 | 40 | 9·768348 | 20 58 | 10·231652 | 9·859932 | 20 89 | 10·140068 | 10·091584 | 20 30 | 9·908416 | 20 | 5 |
| 30 | 42 | 9·768435 | 21 61 | 10·231565 | 9·860065 | 21 93 | 10·139935 | 10·091630 | 21 32 | 9·908370 | 18 | 30 |
| 56 | 44 | 9·768522 | 22 64 | 10·231478 | 9·860198 | 22 97 | 10·139802 | 10·091676 | 22 34 | 9·908324 | 16 | 4 |
| 30 | 46 | 9·768609 | 23 67 | 10·231391 | 9·860331 | 23 102 | 10·139669 | 10·091721 | 23 35 | 9·908279 | 14 | 30 |
| 57 | 48 | 9·768697 | 24 70 | 10·231303 | 9·860464 | 24 106 | 10·139536 | 10·091767 | 24 36 | 9·908233 | 12 | 3 |
| 30 | 50 | 9·768784 | 25 73 | 10·231216 | 9·860597 | 25 111 | 10·139403 | 10·091813 | 25 38 | 9·908187 | 10 | 30 |
| 58 | 52 | 9·768871 | 26 76 | 10·231129 | 9·860730 | 26 115 | 10·139270 | 10·091859 | 26 40 | 9·908141 | 8 | 2 |
| 30 | 54 | 9·768958 | 27 79 | 10·231042 | 9·860862 | 27 120 | 10·139138 | 10·091905 | 27 41 | 9·908095 | 6 | 30 |
| 59 | 56 | 9·769045 | 28 81 | 10·230955 | 9·860995 | 28 124 | 10·139005 | 10·091951 | 28 43 | 9·908049 | 4 | 1 |
| 30 | 58 | 9·769132 | 29 84 | 10·230868 | 9·861128 | 29 128 | 10·138872 | 10·091997 | 29 44 | 9·908003 | 2 | 30 |
| 60 | **24** | 9·769219 | 30 87 | 10·230781 | 9·861261 | 30 133 | 10·138739 | 10·092042 | 30 46 | 9·907958 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | 54° | | | | | | | $3^h\ 36^m$ |

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

2h 24m — 36°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·769219 | | 10·230781 | 9·861261 | | 10·138739 | 10·092042 | | 9·907958 | 36 | 60 |
| 30 | 2 | 9·769306 | 1″ 3 | 10·230694 | 9·861394 | 1″ 4 | 10·138606 | 10·092088 | 1″ 2 | 9·907912 | 58 | 30 |
| 1 | 4 | 9·769393 | 2 6 | 10·230607 | 9·861527 | 2 9 | 10·138473 | 10·092134 | 2 3 | 9·907866 | 56 | 59 |
| 30 | 6 | 9·769479 | 3 9 | 10·230521 | 9·861659 | 3 13 | 10·138341 | 10·092180 | 3 5 | 9·907820 | 54 | 30 |
| 2 | 8 | 9·769566 | 4 12 | 10·230434 | 9·861792 | 4 18 | 10·138208 | 10·092226 | 4 6 | 9·907774 | 52 | 58 |
| 30 | 10 | 9·769653 | 5 14 | 10·230347 | 9·861925 | 5 22 | 10·138075 | 10·092272 | 5 8 | 9·907728 | 50 | 30 |
| 3 | 12 | 9·769740 | 6 17 | 10·230260 | 9·862058 | 6 27 | 10·137942 | 10·092318 | 6 9 | 9·907682 | 48 | 57 |
| 30 | 14 | 9·769827 | 7 20 | 10·230173 | 9·862191 | 7 31 | 10·137809 | 10·092364 | 7 11 | 9·907636 | 46 | 30 |
| 4 | 16 | 9·769913 | 8 23 | 10·230087 | 9·862323 | 8 35 | 10·137677 | 10·092410 | 8 12 | 9·907590 | 44 | 56 |
| 30 | 18 | 9·770000 | 9 26 | 10·230000 | 9·862456 | 9 40 | 10·137544 | 10·092456 | 9 14 | 9·907544 | 42 | 30 |
| 5 | 20 | 9·770087 | 10 29 | 10·229913 | 9·862589 | 10 44 | 10·137411 | 10·092502 | 10 15 | 9·907498 | 40 | 55 |
| 30 | 22 | 9·770173 | 11 32 | 10·229827 | 9·862721 | 11 49 | 10·137279 | 10·092548 | 11 17 | 9·907452 | 38 | 30 |
| 6 | 24 | 9·770260 | 12 35 | 10·229740 | 9·862854 | 12 53 | 10·137146 | 10·092594 | 12 18 | 9·907406 | 36 | 54 |
| 30 | 26 | 9·770347 | 13 37 | 10·229653 | 9·862987 | 13 57 | 10·137013 | 10·092640 | 13 20 | 9·907360 | 34 | 30 |
| 7 | 28 | 9·770433 | 14 40 | 10·229567 | 9·863119 | 14 62 | 10·136881 | 10·092686 | 14 21 | 9·907314 | 32 | 53 |
| 30 | 30 | 9·770520 | 15 43 | 10·229480 | 9·863252 | 15 66 | 10·136748 | 10·092732 | 15 23 | 9·907268 | 30 | 30 |
| 8 | 32 | 9·770606 | 16 46 | 10·229394 | 9·863385 | 16 71 | 10·136615 | 10·092778 | 16 25 | 9·907222 | 28 | 52 |
| 30 | 34 | 9·770693 | 17 49 | 10·229307 | 9·863517 | 17 75 | 10·136483 | 10·092825 | 17 26 | 9·907175 | 26 | 30 |
| 9 | 36 | 9·770779 | 18 52 | 10·229221 | 9·863650 | 18 80 | 10·136350 | 10·092871 | 18 28 | 9·907129 | 24 | 51 |
| 30 | 38 | 9·770866 | 19 55 | 10·229134 | 9·863783 | 19 84 | 10·136217 | 10·092917 | 19 29 | 9·907083 | 22 | 30 |
| 10 | 40 | 9·770952 | 20 58 | 10·229048 | 9·863915 | 20 88 | 10·136085 | 10·092963 | 20 31 | 9·907037 | 20 | 50 |
| 30 | 42 | 9·771039 | 21 60 | 10·228961 | 9·864048 | 21 93 | 10·135952 | 10·093009 | 21 32 | 9·906991 | 18 | 30 |
| 11 | 44 | 9·771125 | 22 63 | 10·228875 | 9·864180 | 22 97 | 10·135820 | 10·093055 | 22 34 | 9·906945 | 16 | 49 |
| 30 | 46 | 9·771211 | 23 66 | 10·228789 | 9·864313 | 23 102 | 10·135687 | 10·093102 | 23 35 | 9·906898 | 14 | 30 |
| 12 | 48 | 9·771298 | 24 69 | 10·228702 | 9·864445 | 24 106 | 10·135555 | 10·093148 | 24 37 | 9·906852 | 12 | 48 |
| 30 | 50 | 9·771384 | 25 72 | 10·228616 | 9·864578 | 25 110 | 10·135422 | 10·093194 | 25 38 | 9·906806 | 10 | 30 |
| 13 | 52 | 9·771470 | 26 75 | 10·228530 | 9·864710 | 26 115 | 10·135290 | 10·093240 | 26 40 | 9·906760 | 8 | 47 |
| 30 | 54 | 9·771556 | 27 78 | 10·228444 | 9·864843 | 27 119 | 10·135157 | 10·093287 | 27 41 | 9·906713 | 6 | 30 |
| 14 | 56 | 9·771643 | 28 81 | 10·228357 | 9·864975 | 28 124 | 10·135025 | 10·093333 | 28 43 | 9·906667 | 4 | 46 |
| 30 | 58 | 9·771729 | 29 84 | 10·228271 | 9·865108 | 29 128 | 10·134892 | 10·093379 | 29 45 | 9·906621 | 2 | 30 |
| 15 | 25 | 9·771815 | 30 86 | 10·228185 | 9·865240 | 30 133 | 10·134760 | 10·093425 | 30 46 | 9·906575 | 35 | 45 |
| 30 | 2 | 9·771901 | 1 3 | 10·228099 | 9·865373 | 1 4 | 10·134627 | 10·093472 | 1 2 | 9·906528 | 58 | 30 |
| 16 | 4 | 9·771987 | ·2 6 | 10·228013 | 9·865505 | 2 9 | 10·134495 | 10·093518 | 2 3 | 9·906482 | 56 | 44 |
| 30 | 6 | 9·772073 | 3 9 | 10·227927 | 9·865638 | 3 13 | 10·134362 | 10·093564 | 3 5 | 9·906436 | 54 | 30 |
| 17 | 8 | 9·772159 | 4 11 | 10·227841 | 9·865770 | 4 18 | 10·134230 | 10·093611 | 4 6 | 9·906389 | 52 | 43 |
| 30 | 10 | 9·772245 | 5 14 | 10·227755 | 9·865903 | 5 22 | 10·134097 | 10·093657 | 5 8 | 9·906343 | 50 | 30 |
| 18 | 12 | 9·772331 | 6 17 | 10·227669 | 9·866035 | 6 26 | 10·133965 | 10·093704 | 6 9 | 9·906296 | 48 | 42 |
| 30 | 14 | 9·772417 | 7 20 | 10·227583 | 9·866167 | 7 31 | 10·133833 | 10·093750 | 7 11 | 9·906250 | 46 | 30 |
| 19 | 16 | 9·772503 | 8 23 | 10·227497 | 9·866300 | 8 35 | 10·133700 | 10·093796 | 8 12 | 9·906204 | 44 | 41 |
| 30 | 18 | 9·772589 | 9 26 | 10·227411 | 9·866432 | 9 40 | 10·133568 | 10·093843 | 9 14 | 9·906157 | 42 | 30 |
| 20 | 20 | 9·772675 | 10 29 | 10·227325 | 9·866564 | 10 44 | 10·133436 | 10·093889 | 10 15 | 9·906111 | 40 | 40 |
| 30 | 22 | 9·772761 | 11 32 | 10·227239 | 9·866697 | 11 49 | 10·133303 | 10·093936 | 11 17 | 9·906064 | 38 | 30 |
| 21 | 24 | 9·772847 | 12 34 | 10·227153 | 9·866829 | 12 53 | 10·133171 | 10·093982 | 12 19 | 9·906018 | 36 | 39 |
| 30 | 26 | 9·772933 | 13 37 | 10·227067 | 9·866961 | 13 57 | 10·133039 | 10·094029 | 13 20 | 9·905971 | 34 | 30 |
| 22 | 28 | 9·773018 | 14 40 | 10·226982 | 9·867094 | 14 62 | 10·132906 | 10·094075 | 14 22 | 9·905925 | 32 | 38 |
| 30 | 30 | 9·773104 | 15 43 | 10·226896 | 9·867226 | 15 66 | 10·132774 | 10·094122 | 15 23 | 9·905878 | 30 | 30 |
| 23 | 32 | 9·773190 | 16 46 | 10·226810 | 9·867358 | 16 71 | 10·132642 | 10·094168 | 16 25 | 9·905832 | 28 | 37 |
| 30 | 34 | 9·773276 | 17 49 | 10·226724 | 9·867491 | 17 75 | 10·132509 | 10·094215 | 17 26 | 9·905785 | 26 | 30 |
| 24 | 36 | 9·773361 | 18 51 | 10·226639 | 9·867623 | 18 79 | 10·132377 | 10·094261 | 18 28 | 9·905739 | 24 | 36 |
| 30 | 38 | 9·773447 | 19 54 | 10·226553 | 9·867755 | 19 84 | 10·132245 | 10·094308 | 19 29 | 9·905692 | 22 | 30 |
| 25 | 40 | 9·773533 | 20 57 | 10·226467 | 9·867887 | 20 88 | 10·132113 | 10·094355 | 20 31 | 9·905645 | 20 | 35 |
| 30 | 42 | 9·773618 | 21 60 | 10·226382 | 9·868019 | 21 93 | 10·131981 | 10·094401 | 21 33 | 9·905599 | 18 | 30 |
| 26 | 44 | 9·773704 | 22 63 | 10·226296 | 9·868152 | 22 97 | 10·131848 | 10·094448 | 22 34 | 9·905552 | 16 | 34 |
| 30 | 46 | 9·773789 | 23 66 | 10·226211 | 9·868284 | 23 101 | 10·131716 | 10·094494 | 23 36 | 9·905506 | 14 | 30 |
| 27 | 48 | 9·773875 | 24 69 | 10·226125 | 9·868416 | 24 106 | 10·131584 | 10·094541 | 24 37 | 9·905459 | 12 | 33 |
| 30 | 50 | 9·773960 | 25 72 | 10·226040 | 9·868548 | 25 110 | 10·131452 | 10·094588 | 25 39 | 9·905412 | 10 | 30 |
| 28 | 52 | 9·774046 | 26 74 | 10·225954 | 9·868680 | 26 115 | 10·131320 | 10·094634 | 26 40 | 9·905366 | 8 | 32 |
| 30 | 54 | 9·774131 | 27 77 | 10·225869 | 9·868813 | 27 119 | 10·131187 | 10·094681 | 27 42 | 9·905319 | 6 | 30 |
| 29 | 56 | 9·774217 | 28 80 | 10·225783 | 9·868945 | 28 123 | 10·131055 | 10·094728 | 28 43 | 9·905272 | 4 | 31 |
| 30 | 58 | 9·774302 | 29 83 | 10·225698 | 9·869077 | 29 128 | 10·130923 | 10·094775 | 29 45 | 9·905225 | 2 | 30 |
| 30 | 26 | 9·774388 | 30 86 | 10·225612 | 9·869209 | 30 132 | 10·130791 | 10·094821 | 30 46 | 9·905179 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

53° — 3h 34m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

2ʰ 26ᵐ — 36°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·774388 | | 10·225612 | 9·869209 | | 10·130791 | 10·094821 | | 9·905179 | 34 | 30 |
| 30 | 2 | 9·774473 | 1″ 3 | 10·225527 | 9·869341 | 1″ 4 | 10·130659 | 10·094868 | 1″ 2 | 9·905132 | 58 | 30 |
| 31 | 4 | 9·774558 | 2 6 | 10·225442 | 9·869473 | 2 9 | 10·130527 | 10·094915 | 2 3 | 9·905085 | 56 | 29 |
| 30 | 6 | 9·774644 | 3 8 | 10·225356 | 9·869605 | 3 13 | 10·130395 | 10·094962 | 3 5 | 9·905038 | 54 | 30 |
| 32 | 8 | 9·774729 | 4 11 | 10·225271 | 9·869737 | 4 18 | 10·130263 | 10·095008 | 4 6 | 9·904992 | 52 | 28 |
| 30 | 10 | 9·774814 | 5 14 | 10·225186 | 9·869869 | 5 22 | 10·130131 | 10·095055 | 5 8 | 9·904945 | 50 | 30 |
| 33 | 12 | 9·774899 | 6 17 | 10·225101 | 9·870001 | 6 26 | 10·129999 | 10·095102 | 6 9 | 9·904898 | 48 | 27 |
| 30 | 14 | 9·774985 | 7 20 | 10·225015 | 9·870133 | 7 31 | 10·129867 | 10·095149 | 7 11 | 9·904851 | 46 | 30 |
| 34 | 16 | 9·775070 | 8 23 | 10·224930 | 9·870265 | 8 35 | 10·129735 | 10·095196 | 8 13 | 9·904804 | 44 | 26 |
| 30 | 18 | 9·775155 | 9 25 | 10·224845 | 9·870397 | 9 40 | 10·129603 | 10·095243 | 9 14 | 9·904757 | 42 | 30 |
| 35 | 20 | 9·775240 | 10 28 | 10·224760 | 9·870529 | 10 44 | 10·129471 | 10·095289 | 10 16 | 9·904711 | 40 | 25 |
| 30 | 22 | 9·775325 | 11 31 | 10·224675 | 9·870661 | 11 48 | 10·129339 | 10·095336 | 11 17 | 9·904664 | 38 | 30 |
| 36 | 24 | 9·775410 | 12 34 | 10·224590 | 9·870793 | 12 53 | 10·129207 | 10·095383 | 12 19 | 9·904617 | 36 | 24 |
| 30 | 26 | 9·775495 | 13 37 | 10·224505 | 9·870925 | 13 57 | 10·129075 | 10·095430 | 13 20 | 9·904570 | 34 | 30 |
| 37 | 28 | 9·775580 | 14 40 | 10·224420 | 9·871057 | 14 62 | 10·128943 | 10·095477 | 14 22 | 9·904523 | 32 | 23 |
| 30 | 30 | 9·775665 | 15 42 | 10·224335 | 9·871189 | 15 66 | 10·128811 | 10·095524 | 15 24 | 9·904476 | 30 | 30 |
| 38 | 32 | 9·775750 | 16 45 | 10·224250 | 9·871321 | 16 70 | 10·128679 | 10·095571 | 16 25 | 9·904429 | 28 | 22 |
| 30 | 34 | 9·775835 | 17 48 | 10·224165 | 9·871453 | 17 75 | 10·128547 | 10·095618 | 17 27 | 9·904382 | 26 | 30 |
| 39 | 36 | 9·775920 | 18 51 | 10·224080 | 9·871585 | 18 79 | 10·128415 | 10·095665 | 18 28 | 9·904335 | 24 | 21 |
| 30 | 38 | 9·776005 | 19 54 | 10·223995 | 9·871717 | 19 84 | 10·128283 | 10·095712 | 19 30 | 9·904288 | 22 | 30 |
| 40 | 40 | 9·776090 | 20 57 | 10·223910 | 9·871849 | 20 88 | 10·128151 | 10·095759 | 20 31 | 9·904241 | 20 | 20 |
| 30 | 42 | 9·776175 | 21 59 | 10·223825 | 9·871980 | 21 92 | 10·128020 | 10·095806 | 21 33 | 9·904194 | 18 | 30 |
| 41 | 44 | 9·776259 | 22 62 | 10·223741 | 9·872112 | 22 97 | 10·127888 | 10·095853 | 22 34 | 9·904147 | 16 | 19 |
| 30 | 46 | 9·776344 | 23 65 | 10·223656 | 9·872244 | 23 101 | 10·127756 | 10·095900 | 23 36 | 9·904100 | 14 | 30 |
| 42 | 48 | 9·776429 | 24 68 | 10·223571 | 9·872376 | 24 106 | 10·127624 | 10·095947 | 24 38 | 9·904053 | 12 | 18 |
| 30 | 50 | 9·776514 | 25 71 | 10·223486 | 9·872508 | 25 110 | 10·127492 | 10·095994 | 25 39 | 9·904006 | 10 | 30 |
| 43 | 52 | 9·776598 | 26 74 | 10·223402 | 9·872640 | 26 114 | 10·127360 | 10·096041 | 26 41 | 9·903959 | 8 | 17 |
| 30 | 54 | 9·776683 | 27 76 | 10·223317 | 9·872771 | 27 119 | 10·127229 | 10·096088 | 27 42 | 9·903912 | 6 | 30 |
| 44 | 56 | 9·776768 | 28 79 | 10·223232 | 9·872903 | 28 123 | 10·127097 | 10·096136 | 28 44 | 9·903864 | 4 | 16 |
| 30 | 58 | 9·776852 | 29 82 | 10·223148 | 9·873035 | 29 128 | 10·126965 | 10·096183 | 29 46 | 9·903817 | 2 | 30 |
| 45 | **27** | 9·776937 | 30 85 | 10·223063 | 9·873167 | 30 132 | 10·126833 | 10·096230 | 30 47 | 9·903770 | **33** | 15 |
| 30 | 2 | 9·777021 | 1 3 | 10·222979 | 9·873299 | 1 4 | 10·126701 | 10·096277 | 1 2 | 9·903723 | 58 | 30 |
| 46 | 4 | 9·777106 | 2 6 | 10·222894 | 9·873430 | 2 9 | 10·126570 | 10·096324 | 2 3 | 9·903676 | 56 | 14 |
| 30 | 6 | 9·777191 | 3 8 | 10·222809 | 9·873562 | 3 13 | 10·126438 | 10·096371 | 3 5 | 9·903629 | 54 | 30 |
| 47 | 8 | 9·777275 | 4 11 | 10·222725 | 9·873694 | 4 18 | 10·126306 | 10·096419 | 4 6 | 9·903581 | 52 | 13 |
| 30 | 10 | 9·777359 | 5 14 | 10·222641 | 9·873825 | 5 22 | 10·126175 | 10·096466 | 5 8 | 9·903534 | 50 | 30 |
| 48 | 12 | 9·777444 | 6 17 | 10·222556 | 9·873957 | 6 26 | 10·126043 | 10·096513 | 6 9 | 9·903487 | 48 | 12 |
| 30 | 14 | 9·777528 | 7 20 | 10·222472 | 9·874089 | 7 31 | 10·125911 | 10·096560 | 7 11 | 9·903440 | 46 | 30 |
| 49 | 16 | 9·777613 | 8 22 | 10·222387 | 9·874220 | 8 35 | 10·125780 | 10·096608 | 8 13 | 9·903392 | 44 | 11 |
| 30 | 18 | 9·777697 | 9 25 | 10·222303 | 9·874352 | 9 40 | 10·125648 | 10·096655 | 9 14 | 9·903345 | 42 | 30 |
| 50 | 20 | 9·777781 | 10 28 | 10·222219 | 9·874484 | 10 44 | 10·125516 | 10·096702 | 10 16 | 9·903298 | 40 | 10 |
| 30 | 22 | 9·777866 | 11 31 | 10·222134 | 9·874615 | 11 48 | 10·125385 | 10·096750 | 11 17 | 9·903250 | 38 | 30 |
| 51 | 24 | 9·777950 | 12 34 | 10·222050 | 9·874747 | 12 53 | 10·125253 | 10·096797 | 12 19 | 9·903203 | 36 | 9 |
| 30 | 26 | 9·778034 | 13 37 | 10·221966 | 9·874879 | 13 57 | 10·125121 | 10·096844 | 13 21 | 9·903156 | 34 | 30 |
| 52 | 28 | 9·778119 | 14 40 | 10·221881 | 9·875010 | 14 61 | 10·124990 | 10·096892 | 14 22 | 9·903108 | 32 | 8 |
| 30 | 30 | 9·778203 | 15 42 | 10·221797 | 9·875142 | 15 66 | 10·124858 | 10·096939 | 15 24 | 9·903061 | 30 | 30 |
| 53 | 32 | 9·778287 | 16 45 | 10·221713 | 9·875273 | 16 70 | 10·124727 | 10·096986 | 16 25 | 9·903014 | 28 | 7 |
| 30 | 34 | 9·778371 | 17 48 | 10·221629 | 9·875405 | 17 75 | 10·124595 | 10·097034 | 17 27 | 9·902966 | 26 | 30 |
| 54 | 36 | 9·778455 | 18 51 | 10·221545 | 9·875537 | 18 79 | 10·124463 | 10·097081 | 18 28 | 9·902919 | 24 | 6 |
| 30 | 38 | 9·778539 | 19 53 | 10·221461 | 9·875668 | 19 83 | 10·124332 | 10·097129 | 19 30 | 9·902871 | 22 | 30 |
| 55 | 40 | 9·778624 | 20 56 | 10·221376 | 9·875800 | 20 88 | 10·124200 | 10·097176 | 20 32 | 9·902824 | 20 | 5 |
| 30 | 42 | 9·778708 | 21 59 | 10·221292 | 9·875931 | 21 92 | 10·124069 | 10·097224 | 21 33 | 9·902776 | 18 | 30 |
| 56 | 44 | 9·778792 | 22 62 | 10·221208 | 9·876063 | 22 97 | 10·123937 | 10·097271 | 22 35 | 9·902729 | 16 | 4 |
| 30 | 46 | 9·778876 | 23 65 | 10·221124 | 9·876194 | 23 101 | 10·123806 | 10·097319 | 23 36 | 9·902681 | 14 | 30 |
| 57 | 48 | 9·778960 | 24 67 | 10·221040 | 9·876326 | 24 105 | 10·123674 | 10·097366 | 24 38 | 9·902634 | 12 | 3 |
| 30 | 50 | 9·779044 | 25 70 | 10·220956 | 9·876457 | 25 110 | 10·123543 | 10·097414 | 25 39 | 9·902586 | 10 | 30 |
| 58 | 52 | 9·779128 | 26 73 | 10·220872 | 9·876589 | 26 114 | 10·123411 | 10·097461 | 26 41 | 9·902539 | 8 | 2 |
| 30 | 54 | 9·779211 | 27 76 | 10·220789 | 9·876720 | 27 119 | 10·123280 | 10·097509 | 27 43 | 9·902491 | 6 | 30 |
| 59 | 56 | 9·779295 | 28 79 | 10·220705 | 9·876852 | 28 123 | 10·123148 | 10·097556 | 28 44 | 9·902444 | 4 | 1 |
| 30 | 58 | 9·779379 | 29 81 | 10·220621 | 9·876983 | 29 127 | 10·123017 | 10·097604 | 29 46 | 9·902396 | 2 | 30 |
| 60 | **28** | 9·779463 | 30 84 | 10·220537 | 9·877114 | 30 132 | 10·122886 | 10·097651 | 30 47 | 9·902349 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

53° — 3ʰ 32ᵐ

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

2h 28m — 37°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·779463 | | 10·220537 | 9·877114 | | 10·122886 | 10·097651 | | 9·902349 | **32** | 60 |
| 30 | 2 | 9·779547 | 1″ 3 | 10·220453 | 9·877246 | 1 4 | 10·122754 | 10·097699 | 1″ 2 | 9·902301 | 58 | 30 |
| 1 | 4 | 9·779631 | 2 6 | 10·220369 | 9·877377 | 2 9 | 10·122623 | 10·097747 | 2 3 | 9·902253 | 56 | 59 |
| 30 | 6 | 9·779714 | 3 8 | 10·220286 | 9·877509 | 3 13 | 10·122491 | 10·097794 | 3 5 | 9·902206 | 54 | 30 |
| 2 | 8 | 9·779798 | 4 11 | 10·220202 | 9·877640 | 4 17 | 10·122360 | 10·097842 | 4 6 | 9·902158 | 52 | 58 |
| 30 | 10 | 9·779882 | 5 14 | 10·220118 | 9·877771 | 5 22 | 10·122229 | 10·097890 | 5 8 | 9·902110 | 50 | 30 |
| 3 | 12 | 9·779966 | 6 17 | 10·220034 | 9·877903 | 6 26 | 10·122097 | 10·097937 | 6 10 | 9·902063 | 48 | 57 |
| 30 | 14 | 9·780049 | 7 19 | 10·219951 | 9·878034 | 7 31 | 10·121966 | 10·097985 | 7 11 | 9·902015 | 46 | 30 |
| 4 | 16 | 9·780133 | 8 22 | 10·219867 | 9·878165 | 8 35 | 10·121835 | 10·098033 | 8 13 | 9·901967 | 44 | 56 |
| 30 | 18 | 9·780216 | 9 25 | 10·219784 | 9·878297 | 9 39 | 10·121703 | 10·098080 | 9 14 | 9·901920 | 42 | 30 |
| 5 | 20 | 9·780300 | 10 28 | 10·219700 | 9·878428 | 10 44 | 10·121572 | 10·098128 | 10 16 | 9·901872 | 40 | 55 |
| 30 | 22 | 9·780384 | 11 31 | 10·219616 | 9·878559 | 11 48 | 10·121441 | 10·098176 | 11 18 | 9·901824 | 38 | 30 |
| 6 | 24 | 9·780467 | 12 34 | 10·219533 | 9·878691 | 12 52 | 10·121309 | 10·098224 | 12 19 | 9·901776 | 36 | 54 |
| 30 | 26 | 9·780551 | 13 36 | 10·219449 | 9·878822 | 13 57 | 10·121178 | 10·098271 | 13 21 | 9·901729 | 34 | 30 |
| 7 | 28 | 9·780634 | 14 39 | 10·219366 | 9·878953 | 14 61 | 10·121047 | 10·098319 | 14 22 | 9·901681 | 32 | 53 |
| 30 | 30 | 9·780718 | 15 42 | 10·219282 | 9·879085 | 15 66 | 10·120915 | 10·098367 | 15 24 | 9·901633 | 30 | 30 |
| 8 | 32 | 9·780801 | 16 45 | 10·219199 | 9·879216 | 16 70 | 10·120784 | 10·098415 | 16 25 | 9·901585 | 28 | 52 |
| 30 | 34 | 9·780884 | 17 47 | 10·219116 | 9·879347 | 17 74 | 10·120653 | 10·098463 | 17 27 | 9·901537 | 26 | 30 |
| 9 | 36 | 9·780968 | 18 50 | 10·219032 | 9·879478 | 18 79 | 10·120522 | 10·098510 | 18 29 | 9·901490 | 24 | 51 |
| 30 | 38 | 9·781051 | 19 53 | 10·218949 | 9·879609 | 19 83 | 10·120391 | 10·098558 | 19 30 | 9·901442 | 22 | 30 |
| 10 | 40 | 9·781134 | 20 56 | 10·218866 | 9·879741 | 20 87 | 10·120259 | 10·098606 | 20 32 | 9·901394 | 20 | 50 |
| 30 | 42 | 9·781218 | 21 58 | 10·218782 | 9·879872 | 21 92 | 10·120128 | 10·098654 | 21 33 | 9·901346 | 18 | 30 |
| 11 | 44 | 9·781301 | 22 61 | 10·218699 | 9·880003 | 22 96 | 10·119997 | 10·098702 | 22 35 | 9·901298 | 16 | 49 |
| 30 | 46 | 9·781384 | 23 64 | 10·218616 | 9·880134 | 23 101 | 10·119866 | 10·098750 | 23 37 | 9·901250 | 14 | 30 |
| 12 | 48 | 9·781468 | 24 67 | 10·218532 | 9·880265 | 24 105 | 10·119735 | 10·098798 | 24 38 | 9·901202 | 12 | 48 |
| 30 | 50 | 9·781551 | 25 70 | 10·218449 | 9·880397 | 25 109 | 10·119603 | 10·098846 | 25 40 | 9·901154 | 10 | 30 |
| 13 | 52 | 9·781634 | 26 73 | 10·218366 | 9·880528 | 26 114 | 10·119472 | 10·098894 | 26 41 | 9·901106 | 8 | 47 |
| 30 | 54 | 9·781717 | 27 75 | 10·218283 | 9·880659 | 27 118 | 10·119341 | 10·098942 | 27 43 | 9·901058 | 6 | 30 |
| 14 | 56 | 9·781800 | 28 78 | 10·218200 | 9·880790 | 28 122 | 10·119210 | 10·098990 | 28 45 | 9·901010 | 4 | 46 |
| 30 | 58 | 9·781883 | 29 81 | 10·218117 | 9·880921 | 29 127 | 10·119079 | 10·099038 | 29 46 | 9·900962 | 2 | 30 |
| 15 | **29** | 9·781966 | 30 83 | 10·218034 | 9·881052 | 30 131 | 10·118948 | 10·099086 | 30 48 | 9·900914 | **31** | 45 |
| 30 | 2 | 9·782049 | 1 3 | 10·217951 | 9·881183 | 1 4 | 10·118817 | 10·099134 | 1 2 | 9·900866 | 58 | 30 |
| 16 | 4 | 9·782132 | 2 6 | 10·217868 | 9·881314 | 2 9 | 10·118686 | 10·099182 | 2 3 | 9·900818 | 56 | 44 |
| 30 | 6 | 9·782215 | 3 8 | 10·217785 | 9·881445 | 3 13 | 10·118555 | 10·099230 | 3 5 | 9·900770 | 54 | 30 |
| 17 | 8 | 9·782298 | 4 11 | 10·217702 | 9·881577 | 4 17 | 10·118423 | 10·099278 | 4 6 | 9·900722 | 52 | 43 |
| 30 | 10 | 9·782381 | 5 14 | 10·217619 | 9·881708 | 5 22 | 10·118292 | 10·099326 | 5 8 | 9·900674 | 50 | 30 |
| 18 | 12 | 9·782464 | 6 17 | 10·217536 | 9·881839 | 6 26 | 10·118161 | 10·099374 | 6 10 | 9·900626 | 48 | 42 |
| 30 | 14 | 9·782547 | 7 19 | 10·217453 | 9·881970 | 7 31 | 10·118030 | 10·099422 | 7 11 | 9·900578 | 46 | 30 |
| 19 | 16 | 9·782630 | 8 22 | 10·217370 | 9·882101 | 8 35 | 10·117899 | 10·099471 | 8 13 | 9·900529 | 44 | 41 |
| 30 | 18 | 9·782713 | 9 25 | 10·217287 | 9·882232 | 9 39 | 10·117768 | 10·099519 | 9 14 | 9·900481 | 42 | 30 |
| 20 | 20 | 9·782796 | 10 28 | 10·217204 | 9·882363 | 10 44 | 10·117637 | 10·099567 | 10 16 | 9·900433 | 40 | 40 |
| 30 | 22 | 9·782879 | 11 30 | 10·217121 | 9·882494 | 11 48 | 10·117506 | 10·099615 | 11 18 | 9·900385 | 38 | 30 |
| 21 | 24 | 9·782961 | 12 33 | 10·217039 | 9·882625 | 12 52 | 10·117375 | 10·099663 | 12 19 | 9·900337 | 36 | 39 |
| 30 | 26 | 9·783044 | 13 36 | 10·216956 | 9·882756 | 13 57 | 10·117244 | 10·099711 | 13 21 | 9·900289 | 34 | 30 |
| 22 | 28 | 9·783127 | 14 39 | 10·216873 | 9·882887 | 14 61 | 10·117113 | 10·099760 | 14 23 | 9·900240 | 32 | 38 |
| 30 | 30 | 9·783210 | 15 41 | 10·216790 | 9·883018 | 15 65 | 10·116982 | 10·099808 | 15 24 | 9·900192 | 30 | 30 |
| 23 | 32 | 9·783292 | 16 44 | 10·216708 | 9·883148 | 16 70 | 10·116852 | 10·099856 | 16 26 | 9·900144 | 28 | 37 |
| 30 | 34 | 9·783375 | 17 47 | 10·216625 | 9·883279 | 17 74 | 10·116721 | 10·099904 | 17 27 | 9·900096 | 26 | 30 |
| 24 | 36 | 9·783458 | 18 50 | 10·216542 | 9·883410 | 18 78 | 10·116590 | 10·099953 | 18 29 | 9·900047 | 24 | 36 |
| 30 | 38 | 9·783540 | 19 52 | 10·216460 | 9·883541 | 19 83 | 10·116459 | 10·100001 | 19 31 | 9·899999 | 22 | 30 |
| 25 | 40 | 9·783623 | 20 55 | 10·216377 | 9·883672 | 20 87 | 10·116328 | 10·100049 | 20 32 | 9·899951 | 20 | 35 |
| 30 | 42 | 9·783705 | 21 58 | 10·216295 | 9·883803 | 21 92 | 10·116197 | 10·100098 | 21 34 | 9·899902 | 18 | 30 |
| 26 | 44 | 9·783788 | 22 61 | 10·216212 | 9·883934 | 22 96 | 10·116066 | 10·100146 | 22 35 | 9·899854 | 16 | 34 |
| 30 | 46 | 9·783870 | 23 63 | 10·216130 | 9·884065 | 23 100 | 10·115935 | 10·100194 | 23 37 | 9·899806 | 14 | 30 |
| 27 | 48 | 9·783953 | 24 66 | 10·216047 | 9·884196 | 24 105 | 10·115804 | 10·100243 | 24 39 | 9·899757 | 12 | 33 |
| 30 | 50 | 9·784035 | 25 69 | 10·215965 | 9·884326 | 25 109 | 10·115674 | 10·100291 | 25 40 | 9·899709 | 10 | 30 |
| 28 | 52 | 9·784118 | 26 72 | 10·215882 | 9·884457 | 26 113 | 10·115543 | 10·100340 | 26 42 | 9·899660 | 8 | 32 |
| 30 | 54 | 9·784200 | 27 74 | 10·215800 | 9·884588 | 27 118 | 10·115412 | 10·100388 | 27 43 | 9·899612 | 6 | 30 |
| 29 | 56 | 9·784282 | 28 77 | 10·215718 | 9·884719 | 28 122 | 10·115281 | 10·100436 | 28 45 | 9·899564 | 4 | 31 |
| 30 | 58 | 9·784365 | 29 80 | 10·215635 | 9·884850 | 29 126 | 10·115150 | 10·100485 | 29 47 | 9·899515 | 2 | 30 |
| 30 | **30** | 9·784447 | 30 83 | 10·215553 | 9·884980 | 30 131 | 10·115020 | 10·100533 | 30 48 | 9·899467 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

52° — 3h 30m

TABLE XXVI.—(*continued*).

## LOG. SINES, COSINES, &c.

2h 30m — 37°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·784447 | | 10·215553 | 9·884980 | | 10·115020 | 10·100533 | | 9·899467 | 30 | 30 |
| 30 | 2 | 9·784529 | 1″ 3 | 10·215471 | 9·885111 | 1″ 4 | 10·114889 | 10·100582 | 1″ 2 | 9·899418 | 58 | 30 |
| 31 | 4 | 9·784612 | 2 5 | 10·215388 | 9·885242 | 2 9 | 10·114758 | 10·100630 | 2 3 | 9·899370 | 56 | 29 |
| 30 | 6 | 9·784694 | 3 8 | 10·215306 | 9·885373 | 3 13 | 10·114627 | 10·100679 | 3 5 | 9·899321 | 54 | 30 |
| 32 | 8 | 9·784776 | 4 11 | 10·215224 | 9·885504 | 4 17 | 10·114496 | 10·100727 | 4 6 | 9·899273 | 52 | 28 |
| 30 | 10 | 9·784858 | 5 14 | 10·215142 | 9·885634 | 5 22 | 10·114366 | 10·100776 | 5 8 | 9·899224 | 50 | 30 |
| 33 | 12 | 9·784941 | 6 16 | 10·215059 | 9·885765 | 6 26 | 10·114235 | 10·100824 | 6 10 | 9·899176 | 48 | 27 |
| 30 | 14 | 9·785023 | 7 19 | 10·214977 | 9·885896 | 7 30 | 10·114104 | 10·100873 | 7 11 | 9·899127 | 46 | 30 |
| 34 | 16 | 9·785105 | 8 22 | 10·214895 | 9·886026 | 8 35 | 10·113974 | 10·100922 | 8 13 | 9·899078 | 44 | 26 |
| 30 | 18 | 9·785187 | 9 25 | 10·214813 | 9·886157 | 9 39 | 10·113843 | 10·100970 | 9 15 | 9·899030 | 42 | 30 |
| 35 | 20 | 9·785269 | 10 27 | 10·214731 | 9·886288 | 10 43 | 10·113712 | 10·101019 | 10 16 | 9·898981 | 40 | 25 |
| 30 | 22 | 9·785351 | 11 30 | 10·214649 | 9·886419 | 11 48 | 10·113581 | 10·101067 | 11 18 | 9·898933 | 38 | 30 |
| 36 | 24 | 9·785433 | 12 33 | 10·214567 | 9·886549 | 12 52 | 10·113451 | 10·101116 | 12 19 | 9·898884 | 36 | 24 |
| 30 | 26 | 9·785515 | 13 36 | 10·214485 | 9·886680 | 13 57 | 10·113320 | 10·101165 | 13 21 | 9·898835 | 34 | 30 |
| 37 | 28 | 9·785597 | 14 39 | 10·214403 | 9·886811 | 14 61 | 10·113189 | 10·101213 | 14 23 | 9·898787 | 32 | 23 |
| 30 | 30 | 9·785679 | 15 41 | 10·214321 | 9·886941 | 15 65 | 10·113059 | 10·101262 | 15 24 | 9·898738 | 30 | 30 |
| 38 | 32 | 9·785761 | 16 44 | 10·214239 | 9·887072 | 16 70 | 10·112928 | 10·101311 | 16 26 | 9·898689 | 28 | 22 |
| 30 | 34 | 9·785843 | 17 47 | 10·214157 | 9·887202 | 17 74 | 10·112798 | 10·101359 | 17 28 | 9·898641 | 26 | 30 |
| 39 | 36 | 9·785925 | 18 49 | 10·214075 | 9·887333 | 18 78 | 10·112667 | 10·101408 | 18 29 | 9·898592 | 24 | 21 |
| 30 | 38 | 9·786007 | 19 52 | 10·213993 | 9·887464 | 19 83 | 10·112536 | 10·101457 | 19 31 | 9·898543 | 22 | 30 |
| 40 | 40 | 9·786089 | 20 55 | 10·213911 | 9·887594 | 20 87 | 10·112406 | 10·101506 | 20 32 | 9·898494 | 20 | 20 |
| 30 | 42 | 9·786170 | 21 57 | 10·213830 | 9·887725 | 21 91 | 10·112275 | 10·101554 | 21 34 | 9·898446 | 18 | 30 |
| 41 | 44 | 9·786252 | 22 60 | 10·213748 | 9·887855 | 22 96 | 10·112145 | 10·101603 | 22 36 | 9·898397 | 16 | 19 |
| 30 | 46 | 9·786334 | 23 63 | 10·213666 | 9·887986 | 23 100 | 10·112014 | 10·101652 | 23 37 | 9·898348 | 14 | 30 |
| 42 | 48 | 9·786416 | 24 66 | 10·213584 | 9·888116 | 24 104 | 10·111884 | 10·101701 | 24 39 | 9·898299 | 12 | 18 |
| 30 | 50 | 9·786497 | 25 68 | 10·213503 | 9·888247 | 25 109 | 10·111753 | 10·101750 | 25 41 | 9·898250 | 10 | 30 |
| 43 | 52 | 9·786579 | 26 71 | 10·213421 | 9·888378 | 26 113 | 10·111622 | 10·101798 | 26 42 | 9·898202 | 8 | 17 |
| 30 | 54 | 9·786661 | 27 74 | 10·213339 | 9·888508 | 27 117 | 10·111492 | 10·101847 | 27 44 | 9·898153 | 6 | 30 |
| 44 | 56 | 9·786742 | 28 77 | 10·213258 | 9·888639 | 28 122 | 10·111361 | 10·101896 | 28 46 | 9·898104 | 4 | 16 |
| 30 | 58 | 9·786824 | 29 80 | 10·213176 | 9·888769 | 29 126 | 10·111231 | 10·101945 | 29 47 | 9·898055 | 2 | 30 |
| 45 | 31 | 9·786906 | 30 82 | 10·213094 | 9·888900 | 30 130 | 10·111100 | 10·101994 | 30 48 | 9·898006 | 29 | 15 |
| 30 | 2 | 9·786987 | 1 3 | 10·213013 | 9·889030 | 1 4 | 10·110970 | 10·102043 | 1 2 | 9·897957 | 58 | 30 |
| 46 | 4 | 9·787069 | 2 5 | 10·212931 | 9·889161 | 2 9 | 10·110839 | 10·102092 | 2 3 | 9·897908 | 56 | 14 |
| 30 | 6 | 9·787150 | 3 8 | 10·212850 | 9·889291 | 3 13 | 10·110709 | 10·102141 | 3 5 | 9·897859 | 54 | 30 |
| 47 | 8 | 9·787232 | 4 11 | 10·212768 | 9·889421 | 4 17 | 10·110579 | 10·102190 | 4 7 | 9·897810 | 52 | 13 |
| 30 | 10 | 9·787313 | 5 14 | 10·212687 | 9·889552 | 5 22 | 10·110448 | 10·102239 | 5 8 | 9·897761 | 50 | 30 |
| 48 | 12 | 9·787395 | 6 16 | 10·212605 | 9·889682 | 6 26 | 10·110318 | 10·102288 | 6 10 | 9·897712 | 48 | 12 |
| 30 | 14 | 9·787476 | 7 19 | 10·212524 | 9·889813 | 7 30 | 10·110187 | 10·102337 | 7 11 | 9·897663 | 46 | 30 |
| 49 | 16 | 9·787557 | 8 22 | 10·212443 | 9·889943 | 8 35 | 10·110057 | 10·102386 | 8 13 | 9·897614 | 44 | 11 |
| 30 | 18 | 9·787639 | 9 24 | 10·212361 | 9·890074 | 9 39 | 10·109926 | 10·102435 | 9 15 | 9·897565 | 42 | 30 |
| 50 | 20 | 9·787720 | 10 27 | 10·212280 | 9·890204 | 10 43 | 10·109796 | 10·102484 | 10 16 | 9·897516 | 40 | 10 |
| 30 | 22 | 9·787801 | 11 30 | 10·212199 | 9·890334 | 11 48 | 10·109666 | 10·102533 | 11 18 | 9·897467 | 38 | 30 |
| 51 | 24 | 9·787883 | 12 33 | 10·212117 | 9·890465 | 12 52 | 10·109535 | 10·102582 | 12 20 | 9·897418 | 36 | 9 |
| 30 | 26 | 9·787964 | 13 35 | 10·212036 | 9·890595 | 13 56 | 10·109405 | 10·102631 | 13 21 | 9·897369 | 34 | 30 |
| 52 | 28 | 9·788045 | 14 38 | 10·211955 | 9·890725 | 14 61 | 10·109275 | 10·102680 | 14 23 | 9·897320 | 32 | 8 |
| 30 | 30 | 9·788127 | 15 41 | 10·211873 | 9·890856 | 15 65 | 10·109144 | 10·102729 | 15 25 | 9·897271 | 30 | 30 |
| 53 | 32 | 9·788208 | 16 43 | 10·211792 | 9·890986 | 16 69 | 10·109014 | 10·102778 | 16 26 | 9·897222 | 28 | 7 |
| 30 | 34 | 9·788289 | 17 46 | 10·211711 | 9·891116 | 17 74 | 10·108884 | 10·102828 | 17 28 | 9·897172 | 26 | 30 |
| 54 | 36 | 9·788370 | 18 49 | 10·211630 | 9·891247 | 18 78 | 10·108753 | 10·102877 | 18 29 | 9·897123 | 24 | 6 |
| 30 | 38 | 9·788451 | 19 51 | 10·211549 | 9·891377 | 19 82 | 10·108623 | 10·102926 | 19 31 | 9·897074 | 22 | 30 |
| 55 | 40 | 9·788532 | 20 54 | 10·211468 | 9·891507 | 20 87 | 10·108493 | 10·102975 | 20 33 | 9·897025 | 20 | 5 |
| 30 | 42 | 9·788613 | 21 57 | 10·211387 | 9·891638 | 21 91 | 10·108362 | 10·103024 | 21 34 | 9·896976 | 18 | 30 |
| 56 | 44 | 9·788694 | 22 60 | 10·211306 | 9·891768 | 22 95 | 10·108232 | 10·103074 | 22 36 | 9·896926 | 16 | 4 |
| 30 | 46 | 9·788775 | 23 62 | 10·211225 | 9·891898 | 23 100 | 10·108102 | 10·103123 | 23 38 | 9·896877 | 14 | 30 |
| 57 | 48 | 9·788856 | 24 65 | 10·211144 | 9·892028 | 24 104 | 10·107972 | 10·103172 | 24 39 | 9·896828 | 12 | 3 |
| 30 | 50 | 9·788937 | 25 68 | 10·211063 | 9·892159 | 25 108 | 10·107841 | 10·103221 | 25 41 | 9·896779 | 10 | 30 |
| 58 | 52 | 9·789018 | 26 71 | 10·210982 | 9·892289 | 26 113 | 10·107711 | 10·103271 | 26 42 | 9·896729 | 8 | 2 |
| 30 | 54 | 9·789099 | 27 73 | 10·210901 | 9·892419 | 27 117 | 10·107581 | 10·103320 | 27 44 | 9·896680 | 6 | 30 |
| 59 | 56 | 9·789180 | 28 76 | 10·210820 | 9·892549 | 28 122 | 10·107451 | 10·103369 | 28 46 | 9·896631 | 4 | 1 |
| 30 | 58 | 9·789261 | 29 79 | 10·210739 | 9·892680 | 29 126 | 10·107320 | 10·103419 | 29 48 | 9·806581 | 2 | 30 |
| 60 | 32 | 9·789342 | 30 81 | 10·210658 | 9·892810 | 30 130 | 10·107190 | 10·103468 | 30 49 | 9·896532 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

52° — 3h 28m

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

2h 32m — 38°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·789342 | | 10·210658 | 9·892810 | | 10·107190 | 10·103468 | | 9·896532 | 28 | 60 |
| 30 | 2 | 9·789423 | 1″ 3 | 10·210577 | 9·892940 | 1″ 4 | 10·107060 | 10·103517 | 1″ 2 | 9·896483 | 58 | 30 |
| 1 | 4 | 9·789504 | 2 5 | 10·210496 | 9·893070 | 2 9 | 10·106930 | 10·103567 | 2 3 | 9·896433 | 56 | 59 |
| 30 | 6 | 9·789584 | 3 8 | 10·210416 | 9·893200 | 3 13 | 10·106800 | 10·103616 | 3 5 | 9·896384 | 54 | 30 |
| 2 | 8 | 9·789665 | 4 11 | 10·210335 | 9·893331 | 4 17 | 10·106669 | 10·103665 | 4 7 | 9·896335 | 52 | 58 |
| 30 | 10 | 9·789746 | 5 13 | 10·210254 | 9·893461 | 5 22 | 10·106539 | 10·103715 | 5 8 | 9·896285 | 50 | 30 |
| 3 | 12 | 9·789827 | 6 16 | 10·210173 | 9·893591 | 6 26 | 10·106409 | 10·103764 | 6 10 | 9·896236 | 48 | 57 |
| 30 | 14 | 9·789907 | 7 19 | 10·210093 | 9·893721 | 7 30 | 10·106279 | 10·103814 | 7 12 | 9·896186 | 46 | 30 |
| 4 | 16 | 9·789988 | 8 21 | 10·210012 | 9·893851 | 8 35 | 10·106149 | 10·103863 | 8 13 | 9·896137 | 44 | 56 |
| 30 | 18 | 9·790069 | 9 24 | 10·209931 | 9·893981 | 9 39 | 10·106019 | 10·103913 | 9 15 | 9·896087 | 42 | 30 |
| 5 | 20 | 9·790149 | 10 27 | 10·209851 | 9·894111 | 10 43 | 10·105889 | 10·103962 | 10 16 | 9·896038 | 40 | 55 |
| 30 | 22 | 9·790230 | 11 29 | 10·209770 | 9·894241 | 11 48 | 10·105759 | 10·104012 | 11 18 | 9·895988 | 38 | 30 |
| 6 | 24 | 9·790310 | 12 32 | 10·209690 | 9·894372 | 12 52 | 10·105628 | 10·104061 | 12 20 | 9·895939 | 36 | 54 |
| 30 | 28 | 9·790391 | 13 35 | 10·209609 | 9·894502 | 13 56 | 10·105498 | 10·104111 | 13 21 | 9·895889 | 34 | 30 |
| 7 | 28 | 9·790471 | 14 37 | 10·209529 | 9·894632 | 14 61 | 10·105368 | 10·104160 | 14 23 | 9·895840 | 32 | 53 |
| 30 | 30 | 9·790552 | 15 40 | 10·209448 | 9·894762 | 15 65 | 10·105238 | 10·104210 | 15 25 | 9·895790 | 30 | 30 |
| 8 | 32 | 9·790632 | 16 43 | 10·209368 | 9·894892 | 16 69 | 10·105108 | 10·104259 | 16 26 | 9·895741 | 28 | 52 |
| 30 | 34 | 9·790713 | 17 46 | 10·209287 | 9·895022 | 17 74 | 10·104978 | 10·104309 | 17 28 | 9·895691 | 26 | 30 |
| 9 | 36 | 9·790793 | 18 48 | 10·209207 | 9·895152 | 18 78 | 10·104848 | 10·104359 | 18 30 | 9·895641 | 24 | 51 |
| 30 | 38 | 9·790874 | 19 51 | 10·209126 | 9·895282 | 19 82 | 10·104718 | 10·104408 | 19 31 | 9·895592 | 22 | 30 |
| 10 | 40 | 9·790954 | 20 54 | 10·209046 | 9·895412 | 20 87 | 10·104588 | 10·104458 | 20 33 | 9·895542 | 20 | 50 |
| 30 | 42 | 9·791034 | 21 56 | 10·208966 | 9·895542 | 21 91 | 10·104458 | 10·104507 | 21 35 | 9·895493 | 18 | 30 |
| 11 | 44 | 9·791115 | 22 59 | 10·208885 | 9·895672 | 22 95 | 10·104328 | 10·104557 | 22 36 | 9·895443 | 16 | 49 |
| 30 | 46 | 9·791195 | 23 62 | 10·208805 | 9·895802 | 23 100 | 10·104198 | 10·104607 | 23 38 | 9·895393 | 14 | 30 |
| 12 | 48 | 9·791275 | 24 65 | 10·208725 | 9·895932 | 24 104 | 10·104068 | 10·104657 | 24 40 | 9·895343 | 12 | 48 |
| 30 | 50 | 9·791356 | 25 67 | 10·208644 | 9·896062 | 25 108 | 10·103938 | 10·104706 | 25 41 | 9·895294 | 10 | 30 |
| 13 | 52 | 9·791436 | 26 70 | 10·208564 | 9·896192 | 26 113 | 10·103808 | 10·104756 | 26 43 | 9·895244 | 8 | 47 |
| 30 | 54 | 9·791516 | 27 72 | 10·208484 | 9·896322 | 27 117 | 10·103678 | 10·104806 | 27 45 | 9·895194 | 6 | 30 |
| 14 | 56 | 9·791596 | 28 75 | 10·208404 | 9·896452 | 28 121 | 10·103548 | 10·104855 | 28 46 | 9·895145 | 4 | 46 |
| 30 | 58 | 9·791676 | 29 78 | 10·208324 | 9·896582 | 29 126 | 10·103418 | 10·104905 | 29 48 | 9·895095 | 2 | 30 |
| 15 | 33 | 9·791757 | 30 80 | 10·208243 | 9·896712 | 30 130 | 10·103288 | 10·104955 | 30 50 | 9·895045 | 27 | 45 |
| 30 | 2 | 9·791837 | 1 3 | 10·208163 | 9·896842 | 1 4 | 10·103158 | 10·105005 | 1 2 | 9·894995 | 58 | 30 |
| 16 | 4 | 9·791917 | 2 5 | 10·208083 | 9·896971 | 2 9 | 10·103029 | 10·105055 | 2 3 | 9·894945 | 56 | 44 |
| 30 | 6 | 9·791997 | 3 8 | 10·208003 | 9·897101 | 3 13 | 10·102899 | 10·105104 | 3 5 | 9·894896 | 54 | 30 |
| 17 | 8 | 9·792077 | 4 11 | 10·207923 | 9·897231 | 4 17 | 10·102769 | 10·105154 | 4 7 | 9·894846 | 52 | 43 |
| 30 | 10 | 9·792157 | 5 13 | 10·207843 | 9·897361 | 5 22 | 10·102639 | 10·105204 | 5 8 | 9·894796 | 50 | 30 |
| 18 | 12 | 9·792237 | 6 16 | 10·207763 | 9·897491 | 6 26 | 10·102509 | 10·105254 | 6 10 | 9·894746 | 48 | 42 |
| 30 | 14 | 9·792317 | 7 19 | 10·207683 | 9·897621 | 7 30 | 10·102379 | 10·105304 | 7 12 | 9·894696 | 46 | 30 |
| 19 | 16 | 9·792397 | 8 21 | 10·207603 | 9·897751 | 8 35 | 10·102249 | 10·105354 | 8 13 | 9·894646 | 44 | 41 |
| 30 | 18 | 9·792477 | 9 24 | 10·207523 | 9·897881 | 9 39 | 10·102119 | 10·105404 | 9 15 | 9·894596 | 42 | 30 |
| 20 | 20 | 9·792557 | 10 27 | 10·207443 | 9·898010 | 10 43 | 10·101990 | 10·105454 | 10 17 | 9·894546 | 40 | 40 |
| 30 | 22 | 9·792636 | 11 30 | 10·207364 | 9·898140 | 11 48 | 10·101860 | 10·105504 | 11 18 | 9·894496 | 38 | 30 |
| 21 | 24 | 9·792716 | 12 32 | 10·207284 | 9·898270 | 12 52 | 10·101730 | 10·105554 | 12 20 | 9·894446 | 36 | 39 |
| 30 | 26 | 9·792796 | 13 35 | 10·207204 | 9·898400 | 13 56 | 10·101600 | 10·105604 | 13 22 | 9·894396 | 34 | 30 |
| 22 | 28 | 9·792876 | 14 37 | 10·207124 | 9·898530 | 14 61 | 10·101470 | 10·105654 | 14 23 | 9·894346 | 32 | 38 |
| 30 | 30 | 9·792956 | 15 40 | 10·207044 | 9·898659 | 15 65 | 10·101341 | 10·105704 | 15 25 | 9·894296 | 30 | 30 |
| 23 | 32 | 9·793035 | 16 43 | 10·206965 | 9·898789 | 16 69 | 10·101211 | 10·105754 | 16 27 | 9·894246 | 28 | 37 |
| 30 | 34 | 9·793115 | 17 45 | 10·206885 | 9·898919 | 17 74 | 10·101081 | 10·105804 | 17 28 | 9·894196 | 26 | 30 |
| 24 | 36 | 9·793195 | 18 48 | 10·206805 | 9·899049 | 18 78 | 10·100951 | 10·105854 | 18 30 | 9·894146 | 24 | 36 |
| 30 | 38 | 9·793275 | 19 51 | 10·206725 | 9·899178 | 19 82 | 10·100822 | 10·105904 | 19 32 | 9·894096 | 22 | 30 |
| 25 | 40 | 9·793354 | 20 53 | 10·206646 | 9·899308 | 20 86 | 10·100692 | 10·105954 | 20 33 | 9·894046 | 20 | 35 |
| 30 | 42 | 9·793434 | 21 56 | 10·206566 | 9·899438 | 21 91 | 10·100562 | 10·106004 | 21 35 | 9·893996 | 18 | 30 |
| 26 | 44 | 9·793514 | 22 59 | 10·206486 | 9·899568 | 22 95 | 10·100432 | 10·106054 | 22 37 | 9·893946 | 16 | 34 |
| 30 | 46 | 9·793593 | 23 61 | 10·206407 | 9·899697 | 23 99 | 10·100303 | 10·106104 | 23 38 | 9·893896 | 14 | 30 |
| 27 | 48 | 9·793673 | 24 64 | 10·206327 | 9·899827 | 24 104 | 10·100173 | 10·106154 | 24 40 | 9·893846 | 12 | 33 |
| 30 | 50 | 9·793752 | 25 67 | 10·206248 | 9·899957 | 25 108 | 10·100043 | 10·106205 | 25 42 | 9·893795 | 10 | 30 |
| 28 | 52 | 9·793832 | 26 69 | 10·206168 | 9·900087 | 26 112 | 10·099913 | 10·106255 | 26 43 | 9·893745 | 8 | 32 |
| 30 | 54 | 9·793911 | 27 72 | 10·206089 | 9·900216 | 27 117 | 10·099784 | 10·106305 | 27 45 | 9·893695 | 6 | 30 |
| 29 | 56 | 9·793991 | 28 74 | 10·206009 | 9·900346 | 28 121 | 10·099654 | 10·106355 | 28 47 | 9·893645 | 4 | 31 |
| 30 | 58 | 9·794070 | 29 77 | 10·205930 | 9·900475 | 29 125 | 10·099524 | 10·106405 | 29 48 | 9·893595 | 2 | 30 |
| 30 | 34 | 9·794150 | 30 80 | 10·205850 | 9·900605 | 30 130 | 10·099395 | 10·106456 | 30 50 | 9·893544 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

51° — 8h 26m

## TABLE XXVI.—(continued).

### LOG. SINES, COSINES, &c.

2h 34m — 38°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·794150 | | 10·205850 | 9·900605 | | 10·099395 | 10·106456 | | 9·893544 | 26 | 30 |
| 30 | 2 | 9·794229 | 1″ 3 | 10·205771 | 9·900735 | 1″ 4 | 10·099265 | 10·106506 | 1″ 2 | 9·893494 | 58 | 30 |
| 31 | 4 | 9·794308 | 2 5 | 10·205692 | 9·900864 | 2 9 | 10·099136 | 10·106556 | 2 3 | 9·893444 | 56 | 29 |
| 30 | 6 | 9·794388 | 3 8 | 10·205612 | 9·900994 | 3 13 | 10·099006 | 10·106606 | 3 5 | 9·893394 | 54 | 30 |
| 32 | 8 | 9·794467 | 4 11 | 10·205533 | 9·901124 | 4 17 | 10·098876 | 10·106657 | 4 7 | 9·893343 | 52 | 28 |
| 30 | 10 | 9·794546 | 5 13 | 10·205454 | 9·901253 | 5 22 | 10·098747 | 10·106707 | 5 8 | 9·893293 | 50 | 30 |
| 33 | 12 | 9·794626 | 6 16 | 10·205374 | 9·901383 | 6 26 | 10·098617 | 10·106757 | 6 10 | 9·893243 | 48 | 27 |
| 30 | 14 | 9·794705 | 7 19 | 10·205295 | 9·901513 | 7 30 | 10·098487 | 10·106808 | 7 12 | 9·893192 | 46 | 30 |
| 34 | 16 | 9·794784 | 8 21 | 10·205216 | 9·901642 | 8 35 | 10·098358 | 10·106858 | 8 13 | 9·893142 | 44 | 26 |
| 30 | 18 | 9·794863 | 9 24 | 10·205137 | 9·901772 | 9 39 | 10·098228 | 10·106908 | 9 15 | 9·893092 | 42 | 30 |
| 35 | 20 | 9·794942 | 10 26 | 10·205058 | 9·901901 | 10 43 | 10·098099 | 10·106959 | 10 17 | 9·893041 | 40 | 25 |
| 30 | 22 | 9·795022 | 11 29 | 10·204978 | 9·902031 | 11 48 | 10·097969 | 10·107009 | 11 18 | 9·892991 | 38 | 30 |
| 36 | 24 | 9·795101 | 12 32 | 10·204899 | 9·902160 | 12 52 | 10·097840 | 10·107060 | 12 20 | 9·892940 | 36 | 24 |
| 30 | 26 | 9·795180 | 13 34 | 10·204820 | 9·902290 | 13 56 | 10·097710 | 10·107110 | 13 22 | 9·892890 | 34 | 30 |
| 37 | 28 | 9·795259 | 14 37 | 10·204741 | 9·902420 | 14 60 | 10·097580 | 10·107161 | 14 24 | 9·892839 | 32 | 23 |
| 30 | 30 | 9·795338 | 15 39 | 10·204662 | 9·902549 | 15 65 | 10·097451 | 10·107211 | 15 25 | 9·892789 | 30 | 30 |
| 38 | 32 | 9·795417 | 16 42 | 10·204583 | 9·902679 | 16 69 | 10·097321 | 10·107261 | 16 27 | 9·892739 | 28 | 22 |
| 30 | 34 | 9·795496 | 17 45 | 10·204504 | 9·902808 | 17 73 | 10·097192 | 10·107312 | 17 29 | 9·892688 | 26 | 30 |
| 39 | 36 | 9·795575 | 18 47 | 10·204425 | 9·902938 | 18 78 | 10·097062 | 10·107362 | 18 30 | 9·892638 | 24 | 21 |
| 30 | 38 | 9·795654 | 19 50 | 10·204346 | 9·903067 | 19 82 | 10·096933 | 10·107413 | 19 32 | 9·892587 | 22 | 30 |
| 40 | 40 | 9·795733 | 20 53 | 10·204267 | 9·903197 | 20 86 | 10·096803 | 10·107464 | 20 34 | 9·892536 | 20 | 20 |
| 30 | 42 | 9·795812 | 21 55 | 10·204188 | 9·903326 | 21 91 | 10·096674 | 10·107514 | 21 35 | 9·892486 | 18 | 30 |
| 41 | 44 | 9·795891 | 22 58 | 10·204109 | 9·903456 | 22 95 | 10·096544 | 10·107565 | 22 37 | 9·892435 | 16 | 19 |
| 30 | 46 | 9·795970 | 23 60 | 10·204030 | 9·903585 | 23 99 | 10·096415 | 10·107615 | 23 39 | 9·892385 | 14 | 30 |
| 42 | 48 | 9·796049 | 24 63 | 10·203951 | 9·903714 | 24 104 | 10·096286 | 10·107666 | 24 40 | 9·892334 | 12 | 18 |
| 30 | 50 | 9·796127 | 25 66 | 10·203873 | 9·903844 | 25 108 | 10·096156 | 10·107716 | 25 42 | 9·892284 | 10 | 30 |
| 43 | 52 | 9·796206 | 26 68 | 10·203794 | 9·903973 | 26 112 | 10·096027 | 10·107767 | 26 44 | 9·892233 | 8 | 17 |
| 30 | 54 | 9·796285 | 27 71 | 10·203715 | 9·904103 | 27 117 | 10·095897 | 10·107818 | 27 45 | 9·892182 | 6 | 30 |
| 44 | 56 | 9·796364 | 28 74 | 10·203636 | 9·904232 | 28 121 | 10·095768 | 10·107868 | 28 47 | 9·892132 | 4 | 16 |
| 30 | 58 | 9·796443 | 29 76 | 10·203557 | 9·904362 | 29 125 | 10·095638 | 10·107919 | 29 49 | 9·892081 | 2 | 30 |
| 45 | 35 | 9·796521 | 30 79 | 10·203479 | 9·904491 | 30 130 | 10·095509 | 10·107970 | 30 50 | 9·892030 | 25 | 15 |
| 30 | 2 | 9·796600 | 1 3 | 10·203400 | 9·904620 | 1 4 | 10·095380 | 10·108020 | 1 2 | 9·891980 | 58 | 30 |
| 46 | 4 | 9·796679 | 2 5 | 10·203321 | 9·904750 | 2 9 | 10·095250 | 10·108071 | 2 3 | 9·891929 | 56 | 14 |
| 30 | 6 | 9·796757 | 3 8 | 10·203243 | 9·904879 | 3 13 | 10·095121 | 10·108122 | 3 5 | 9·891878 | 54 | 30 |
| 47 | 8 | 9·796836 | 4 10 | 10·203164 | 9·905008 | 4 17 | 10·094992 | 10·108173 | 4 7 | 9·891827 | 52 | 13 |
| 30 | 10 | 9·796914 | 5 13 | 10·203086 | 9·905138 | 5 22 | 10·094862 | 10·108223 | 5 8 | 9·891777 | 50 | 30 |
| 48 | 12 | 9·796993 | 6 16 | 10·203007 | 9·905267 | 6 26 | 10·094733 | 10·108274 | 6 10 | 9·891726 | 48 | 12 |
| 30 | 14 | 9·797072 | 7 18 | 10·202928 | 9·905397 | 7 30 | 10·094603 | 10·108325 | 7 12 | 9·891675 | 46 | 30 |
| 49 | 16 | 9·797150 | 8 21 | 10·202850 | 9·905526 | 8 34 | 10·094474 | 10·108376 | 8 14 | 9·891624 | 44 | 11 |
| 30 | 18 | 9·797229 | 9 23 | 10·202771 | 9·905655 | 9 39 | 10·094345 | 10·108427 | 9 15 | 9·891573 | 42 | 30 |
| 50 | 20 | 9·797307 | 10 26 | 10·202693 | 9·905785 | 10 43 | 10·094215 | 10·108477 | 10 17 | 9·891523 | 40 | 10 |
| 30 | 22 | 9·797386 | 11 29 | 10·202614 | 9·905914 | 11 47 | 10·094086 | 10·108528 | 11 19 | 9·891472 | 38 | 30 |
| 51 | 24 | 9·797464 | 12 31 | 10·202536 | 9·906043 | 12 52 | 10·093957 | 10·108579 | 12 20 | 9·891421 | 36 | 9 |
| 30 | 26 | 9·797542 | 13 34 | 10·202458 | 9·906172 | 13 56 | 10·093828 | 10·108630 | 13 22 | 9·891370 | 34 | 30 |
| 52 | 28 | 9·797621 | 14 37 | 10·202379 | 9·906302 | 14 60 | 10·093698 | 10·108681 | 14 24 | 9·891319 | 32 | 8 |
| 30 | 30 | 9·797699 | 15 39 | 10·202301 | 9·906431 | 15 65 | 10·093569 | 10·108732 | 15 25 | 9·891268 | 30 | 30 |
| 53 | 32 | 9·797777 | 16 42 | 10·202223 | 9·906560 | 16 69 | 10·093440 | 10·108783 | 16 27 | 9·891217 | 28 | 7 |
| 30 | 34 | 9·797856 | 17 45 | 10·202144 | 9·906690 | 17 73 | 10·093310 | 10·108834 | 17 29 | 9·891166 | 26 | 30 |
| 54 | 36 | 9·797934 | 18 47 | 10·202066 | 9·906819 | 18 78 | 10·093181 | 10·108885 | 18 31 | 9·891115 | 24 | 6 |
| 30 | 38 | 9·798012 | 19 50 | 10·201988 | 9·906948 | 19 82 | 10·093052 | 10·108936 | 19 32 | 9·891064 | 22 | 30 |
| 55 | 40 | 9·798091 | 20 52 | 10·201909 | 9·907077 | 20 86 | 10·092923 | 10·108987 | 20 34 | 9·891013 | 20 | 5 |
| 30 | 42 | 9·798169 | 21 55 | 10·201831 | 9·907207 | 21 91 | 10·092793 | 10·109038 | 21 36 | 9·890962 | 18 | 30 |
| 56 | 44 | 9·798247 | 22 58 | 10·201753 | 9·907336 | 22 95 | 10·092664 | 10·109089 | 22 37 | 9·890911 | 16 | 4 |
| 30 | 46 | 9·798325 | 23 60 | 10·201675 | 9·907465 | 23 99 | 10·092535 | 10·109140 | 23 39 | 9·890860 | 14 | 30 |
| 57 | 48 | 9·798403 | 24 63 | 10·201597 | 9·907594 | 24 103 | 10·092406 | 10·109191 | 24 41 | 9·890809 | 12 | 3 |
| 30 | 50 | 9·798482 | 25 65 | 10·201518 | 9·907723 | 25 108 | 10·092277 | 10·109242 | 25 42 | 9·890758 | 10 | 30 |
| 58 | 52 | 9·798560 | 26 68 | 10·201440 | 9·907853 | 26 112 | 10·092147 | 10·109293 | 26 44 | 9·890707 | 8 | 2 |
| 30 | 54 | 9·798638 | 27 70 | 10·201362 | 9·907982 | 27 116 | 10·092018 | 10·109344 | 27 46 | 9·890656 | 6 | 30 |
| 59 | 56 | 9·798716 | 28 73 | 10·201284 | 9·908111 | 28 121 | 10·091889 | 10·109395 | 28 48 | 9·890605 | 4 | 1 |
| 30 | 58 | 9·798794 | 29 76 | 10·201206 | 9·908240 | 29 125 | 10·091760 | 10·109446 | 29 49 | 9·890554 | 2 | 30 |
| 60 | 36 | 9·798872 | 30 78 | 10·201128 | 9·908369 | 30 129 | 10·091631 | 10·109497 | 30 51 | 9·890503 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

51° — 3h 24m

TABLE XXVI.—(continued).

LOG. SINES, COSINES, &c.

2h 36m — 39°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·798872 | | 10·201128 | 9·908369 | | 10·091631 | 10·109497 | | 9·890503 | 24 | 60 |
| 30 | 2 | 9·798950 | 1″ 3 | 10·201050 | 9·908498 | 1″ 4 | 10·091502 | 10·109549 | 1″ 2 | 9·890451 | 58 | 30 |
| 1 | 4 | 9·799028 | 2 5 | 10·200972 | 9·908628 | 2 9 | 10·091372 | 10·109600 | 2 3 | 9·890400 | 56 | 59 |
| 30 | 6 | 9·799106 | 3 8 | 10·200894 | 9·908757 | 3 13 | 10·091243 | 10·109651 | 3 5 | 9·890349 | 54 | 30 |
| 2 | 8 | 9·799184 | 4 10 | 10·200816 | 9·908886 | 4 17 | 10·091114 | 10·109702 | 4 7 | 9·890298 | 52 | 58 |
| 30 | 10 | 9·799262 | 5 13 | 10·200738 | 9·909015 | 5 21 | 10·090985 | 10·109753 | 5 9 | 9·890247 | 50 | 30 |
| 3 | 12 | 9·799339 | 6 16 | 10·200661 | 9·909144 | 6 26 | 10·090856 | 10·109805 | 6 10 | 9·890195 | 48 | 57 |
| 30 | 14 | 9·799417 | 7 18 | 10·200583 | 9·909273 | 7 30 | 10·090727 | 10·109856 | 7 12 | 9·890144 | 46 | 30 |
| 4 | 16 | 9·799495 | 8 21 | 10·200505 | 9·909402 | 8 34 | 10·090598 | 10·109907 | 8 14 | 9·890093 | 44 | 56 |
| 30 | 18 | 9·799573 | 9 23 | 10·200427 | 9·909531 | 9 38 | 10·090469 | 10·109958 | 9 15 | 9·890042 | 42 | 30 |
| 5 | 20 | 9·799651 | 10 26 | 10·200349 | 9·909660 | 10 43 | 10·090340 | 10·110010 | 10 17 | 9·889990 | 40 | 55 |
| 30 | 22 | 9·799728 | 11 28 | 10·200272 | 9·909789 | 11 47 | 10·090211 | 10·110061 | 11 19 | 9·889939 | 38 | 30 |
| 6 | 24 | 9·799806 | 12 31 | 10·200194 | 9·909918 | 12 52 | 10·090082 | 10·110112 | 12 21 | 9·889888 | 36 | 54 |
| 30 | 26 | 9·799884 | 13 33 | 10·200116 | 9·910048 | 13 56 | 10·089952 | 10·110164 | 13 22 | 9·889836 | 34 | 30 |
| 7 | 28 | 9·799962 | 14 36 | 10·200038 | 9·910177 | 14 60 | 10·089823 | 10·110215 | 14 24 | 9·889785 | 32 | 53 |
| 30 | 30 | 9·800039 | 15 38 | 10·199961 | 9·910306 | 15 64 | 10·089694 | 10·110266 | 15 26 | 9·889734 | 30 | 30 |
| 8 | 32 | 9·800117 | 16 41 | 10·199883 | 9·910435 | 16 69 | 10·089565 | 10·110318 | 16 27 | 9·889682 | 28 | 52 |
| 30 | 34 | 9·800195 | 17 44 | 10·199805 | 9·910564 | 17 73 | 10·089436 | 10·110369 | 17 29 | 9·889631 | 26 | 30 |
| 9 | 36 | 9·800272 | 18 47 | 10·199728 | 9·910693 | 18 77 | 10·089307 | 10·110421 | 18 31 | 9·889579 | 24 | 51 |
| 30 | 38 | 9·800350 | 19 50 | 10·199650 | 9·910822 | 19 82 | 10·089178 | 10·110472 | 19 32 | 9·889528 | 22 | 30 |
| 10 | 40 | 9·800427 | 20 52 | 10·199573 | 9·910951 | 20 86 | 10·089049 | 10·110523 | 20 34 | 9·889477 | 20 | 50 |
| 30 | 42 | 9·800505 | 21 55 | 10·199495 | 9·911080 | 21 90 | 10·088920 | 10·110575 | 21 36 | 9·889425 | 18 | 30 |
| 11 | 44 | 9·800582 | 22 57 | 10·199418 | 9·911209 | 22 95 | 10·088791 | 10·110626 | 22 38 | 9·889374 | 16 | 49 |
| 30 | 46 | 9·800660 | 23 60 | 10·199340 | 9·911338 | 23 99 | 10·088662 | 10·110678 | 23 39 | 9·889322 | 14 | 30 |
| 12 | 48 | 9·800737 | 24 62 | 10·199263 | 9·911467 | 24 103 | 10·088533 | 10·110729 | 24 41 | 9·889271 | 12 | 48 |
| 30 | 50 | 9·800815 | 25 65 | 10·199185 | 9·911596 | 25 107 | 10·088404 | 10·110781 | 25 43 | 9·889219 | 10 | 30 |
| 13 | 52 | 9·800892 | 26 67 | 10·199108 | 9·911725 | 26 112 | 10·088275 | 10·110832 | 26 44 | 9·889168 | 8 | 47 |
| 30 | 54 | 9·800969 | 27 70 | 10·199031 | 9·911853 | 27 116 | 10·088147 | 10·110884 | 27 46 | 9·889116 | 6 | 30 |
| 14 | 56 | 9·801047 | 28 73 | 10·198953 | 9·911982 | 28 120 | 10·088018 | 10·110936 | 28 48 | 9·889064 | 4 | 46 |
| 30 | 58 | 9·801124 | 29 75 | 10·198876 | 9·912111 | 29 125 | 10·087889 | 10·110987 | 29 50 | 9·889013 | 2 | 30 |
| 15 | **37** | 9·801201 | 30 78 | 10·198799 | 9·912240 | 30 129 | 10·087760 | 10·111039 | 30 51 | 9·888961 | **23** | 45 |
| 30 | 2 | 9·801279 | 1 3 | 10·198721 | 9·912369 | 1 4 | 10·087631 | 10·111090 | 1 2 | 9·888910 | 58 | 30 |
| 16 | 4 | 9·801356 | 2 5 | 10·198644 | 9·912498 | 2 9 | 10·087502 | 10·111142 | 2 3 | 9·888858 | 56 | 44 |
| 30 | 6 | 9·801433 | 3 8 | 10·198567 | 9·912627 | 3 13 | 10·087373 | 10·111194 | 3 5 | 9·888806 | 54 | 30 |
| 17 | 8 | 9·801511 | 4 10 | 10·198489 | 9·912756 | 4 17 | 10·087244 | 10·111245 | 4 7 | 9·888755 | 52 | 43 |
| 30 | 10 | 9·801588 | 5 13 | 10·198412 | 9·912885 | 5 21 | 10·087115 | 10·111297 | 5 9 | 9·888703 | 50 | 30 |
| 18 | 12 | 9·801665 | 6 15 | 10·198335 | 9·913014 | 6 26 | 10·086986 | 10·111349 | 6 10 | 9·888651 | 48 | 42 |
| 30 | 14 | 9·801742 | 7 18 | 10·198258 | 9·913143 | 7 30 | 10·086857 | 10·111400 | 7 12 | 9·888600 | 46 | 30 |
| 19 | 16 | 9·801819 | 8 21 | 10·198181 | 9·913271 | 8 34 | 10·086729 | 10·111452 | 8 14 | 9·888548 | 44 | 41 |
| 30 | 18 | 9·801896 | 9 23 | 10·198104 | 9·913400 | 9 39 | 10·086600 | 10·111504 | 9 16 | 9·888496 | 42 | 30 |
| 20 | 20 | 9·801973 | 10 26 | 10·198027 | 9·913529 | 10 43 | 10·086471 | 10·111556 | 10 17 | 9·888444 | 40 | 40 |
| 30 | 22 | 9·802051 | 11 28 | 10·197949 | 9·913658 | 11 47 | 10·086342 | 10·111607 | 11 19 | 9·888393 | 38 | 30 |
| 21 | 24 | 9·802128 | 12 31 | 10·197872 | 9·913787 | 12 51 | 10·086213 | 10·111659 | 12 21 | 9·888341 | 36 | 39 |
| 30 | 26 | 9·802205 | 13 33 | 10·197795 | 9·913916 | 13 56 | 10·086084 | 10·111711 | 13 22 | 9·888289 | 34 | 30 |
| 22 | 28 | 9·802282 | 14 36 | 10·197718 | 9·914044 | 14 60 | 10·085956 | 10·111763 | 14 24 | 9·888237 | 32 | 38 |
| 30 | 30 | 9·802359 | 15 38 | 10·197641 | 9·914173 | 15 64 | 10·085827 | 10·111815 | 15 26 | 9·888185 | 30 | 30 |
| 23 | 32 | 9·802436 | 16 41 | 10·197564 | 9·914302 | 16 69 | 10·085698 | 10·111866 | 16 28 | 9·888134 | 28 | 37 |
| 30 | 34 | 9·802512 | 17 43 | 10·197488 | 9·914431 | 17 73 | 10·085569 | 10·111918 | 17 29 | 9·888082 | 26 | 30 |
| 24 | 36 | 9·802589 | 18 46 | 10·197411 | 9·914560 | 18 77 | 10·085440 | 10·111970 | 18 31 | 9·888030 | 24 | 36 |
| 30 | 38 | 9·802666 | 19 48 | 10·197334 | 9·914688 | 19 82 | 10·085312 | 10·112022 | 19 33 | 9·887978 | 22 | 30 |
| 25 | 40 | 9·802743 | 20 51 | 10·197257 | 9·914817 | 20 86 | 10·085183 | 10·112074 | 20 35 | 9·887926 | 20 | 35 |
| 30 | 42 | 9·802820 | 21 54 | 10·197180 | 9·914946 | 21 90 | 10·085054 | 10·112126 | 21 36 | 9·887874 | 18 | 30 |
| 26 | 44 | 9·802897 | 22 57 | 10·197103 | 9·915075 | 22 94 | 10·084925 | 10·112178 | 22 38 | 9·887822 | 16 | 34 |
| 30 | 46 | 9·802974 | 23 59 | 10·197026 | 9·915203 | 23 99 | 10·084797 | 10·112230 | 23 40 | 9·887770 | 14 | 30 |
| 27 | 48 | 9·803050 | 24 62 | 10·196950 | 9·915332 | 24 103 | 10·084668 | 10·112282 | 24 42 | 9·887718 | 12 | 33 |
| 30 | 50 | 9·803127 | 25 64 | 10·196873 | 9·915461 | 25 107 | 10·084539 | 10·112334 | 25 43 | 9·887666 | 10 | 30 |
| 28 | 52 | 9·803204 | 26 67 | 10·196796 | 9·915590 | 26 112 | 10·084410 | 10·112386 | 26 45 | 9·887614 | 8 | 32 |
| 30 | 54 | 9·803281 | 27 69 | 10·196719 | 9·915718 | 27 116 | 10·084282 | 10·112438 | 27 47 | 9·887562 | 6 | 30 |
| 29 | 56 | 9·803357 | 28 72 | 10·196643 | 9·915847 | 28 120 | 10·084153 | 10·112490 | 28 48 | 9·887510 | 4 | 31 |
| 30 | 58 | 9·803434 | 29 74 | 10·196566 | 9·915976 | 29 124 | 10·084024 | 10·112542 | 29 50 | 9·887458 | 2 | 30 |
| 30 | **38** | 9·803511 | 30 77 | 10·196489 | 9·916104 | 30 129 | 10·083896 | 10·112594 | 30 52 | 9·887406 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

50° — 3h 22m

TABLE XXVI.—*continued*.

LOG. SINES, COSINES, &c.

2h 38m — 39°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·803511 | | 10·196489 | 9·916104 | | 10·083896 | 10·112594 | | 9·887406 | **22** | 30 |
| 30 | 2 | 9·803587 | 1″ 3 | 10·196413 | 9·916233 | 1″ 4 | 10·083767 | 10·112646 | 1″ 2 | 9·887354 | 58 | 30 |
| 31 | 4 | 9·803664 | 2 5 | 10·196336 | 9·916362 | 2 9 | 10·083638 | 10·112698 | 2 3 | 9·887302 | 56 | 29 |
| 30 | 6 | 9·803740 | 3 8 | 10·196260 | 9·916491 | 3 13 | 10·083510 | 10·112750 | 3 5 | 9·887250 | 54 | 30 |
| 32 | 8 | 9·803817 | 4 10 | 10·196183 | 9·916619 | 4 17 | 10·083381 | 10·112802 | 4 7 | 9·887198 | 52 | 28 |
| 30 | 10 | 9·803893 | 5 13 | 10·196107 | 9·916748 | 5 21 | 10·083252 | 10·112854 | 5 9 | 9·887146 | 50 | 30 |
| 33 | 12 | 9·803970 | 6 15 | 10·196030 | 9·916877 | 6 26 | 10·083123 | 10·112907 | 6 10 | 9·887093 | 48 | 27 |
| 30 | 14 | 9·804046 | 7 18 | 10·195954 | 9·917005 | 7 30 | 10·082995 | 10·112959 | 7 12 | 9·887041 | 46 | 30 |
| 34 | 16 | 9·804123 | 8 20 | 10·195877 | 9·917134 | 8 34 | 10·082866 | 10·113011 | 8 14 | 9·886989 | 44 | 26 |
| 30 | 18 | 9·804199 | 9 23 | 10·195801 | 9·917262 | 9 39 | 10·082738 | 10·113063 | 9 16 | 9·886937 | 42 | 30 |
| 35 | 20 | 9·804276 | 10 25 | 10·195724 | 9·917391 | 10 43 | 10·082609 | 10·113115 | 10 17 | 9·886885 | 40 | 25 |
| 30 | 22 | 9·804352 | 11 28 | 10·195648 | 9·917520 | 11 47 | 10·082480 | 10·113168 | 11 19 | 9·886832 | 38 | 30 |
| 36 | 24 | 9·804428 | 12 30 | 10·195572 | 9·917648 | 12 51 | 10·082352 | 10·113220 | 12 21 | 9·886780 | 36 | 24 |
| 30 | 26 | 9·804505 | 13 33 | 10·195495 | 9·917777 | 13 56 | 10·082223 | 10·113272 | 13 23 | 9·886728 | 34 | 30 |
| 37 | 28 | 9·804581 | 14 35 | 10·195419 | 9·917906 | 14 60 | 10·082094 | 10·113324 | 14 24 | 9·886676 | 32 | 23 |
| 30 | 30 | 9·804657 | 15 38 | 10·195343 | 9·918034 | 15 64 | 10·081966 | 10·113377 | 15 26 | 9·886623 | 30 | 30 |
| 38 | 32 | 9·804734 | 16 40 | 10·195266 | 9·918163 | 16 69 | 10·081837 | 10·113429 | 16 28 | 9·886571 | 28 | 22 |
| 30 | 34 | 9·804810 | 17 43 | 10·195190 | 9·918291 | 17 73 | 10·081709 | 10·113481 | 17 30 | 9·886519 | 26 | 30 |
| 39 | 36 | 9·804886 | 18 46 | 10·195114 | 9·918420 | 18 77 | 10·081580 | 10·113534 | 18 31 | 9·886466 | 24 | 21 |
| 30 | 38 | 9·804962 | 19 48 | 10·195038 | 9·918548 | 19 81 | 10·081452 | 10·113586 | 19 33 | 9·886414 | 22 | 30 |
| 40 | 40 | 9·805039 | 20 51 | 10·194961 | 9·918677 | 20 86 | 10·081323 | 10·113638 | 20 35 | 9·886362 | 20 | 20 |
| 30 | 42 | 9·805115 | 21 53 | 10·194885 | 9·918805 | 21 90 | 10·081195 | 10·113691 | 21 37 | 9·886309 | 18 | 30 |
| 41 | 44 | 9·805191 | 22 56 | 10·194809 | 9·918934 | 22 94 | 10·081066 | 10·113743 | 22 38 | 9·886257 | 16 | 19 |
| 30 | 46 | 9·805267 | 23 58 | 10·194733 | 9·919063 | 23 99 | 10·080937 | 10·113796 | 23 40 | 9·886204 | 14 | 30 |
| 42 | 48 | 9·805343 | 24 61 | 10·194657 | 9·919191 | 24 103 | 10·080809 | 10·113848 | 24 42 | 9·886152 | 12 | 18 |
| 30 | 50 | 9·805419 | 25 63 | 10·194581 | 9·919320 | 25 107 | 10·080680 | 10·113901 | 25 44 | 9·886099 | 10 | 30 |
| 43 | 52 | 9·805495 | 26 66 | 10·194505 | 9·919448 | 26 111 | 10·080552 | 10·113953 | 26 45 | 9·886047 | 8 | 17 |
| 30 | 54 | 9·805571 | 27 68 | 10·194429 | 9·919577 | 27 116 | 10·080423 | 10·114005 | 27 47 | 9·885995 | 6 | 30 |
| 44 | 56 | 9·805647 | 28 71 | 10·194353 | 9·919705 | 28 120 | 10·080295 | 10·114058 | 28 49 | 9·885942 | 4 | 16 |
| 30 | 58 | 9·805723 | 29 73 | 10·194277 | 9·919834 | 29 124 | 10·080166 | 10·114110 | 29 50 | 9·885890 | 2 | 30 |
| 45 | **39** | 9·805799 | 30 76 | 10·194201 | 9·919962 | 30 129 | 10·080038 | 10·114163 | 30 52 | 9·885837 | **21** | 15 |
| 30 | 2 | 9·805875 | 1 3 | 10·194125 | 9·920091 | 1 4 | 10·079909 | 10·114216 | 1 2 | 9·885784 | 58 | 30 |
| 46 | 4 | 9·805951 | 2 5 | 10·194049 | 9·920219 | 2 9 | 10·079781 | 10·114268 | 2 4 | 9·885732 | 56 | 14 |
| 30 | 6 | 9·806027 | 3 8 | 10·193973 | 9·920348 | 3 13 | 10·079652 | 10·114321 | 3 5 | 9·885679 | 54 | 30 |
| 47 | 8 | 9·806103 | 4 10 | 10·193897 | 9·920476 | 4 17 | 10·079524 | 10·114373 | 4 7 | 9·885627 | 52 | 13 |
| 30 | 10 | 9·806179 | 5 13 | 10·193821 | 9·920604 | 5 21 | 10·079396 | 10·114426 | 5 9 | 9·885574 | 50 | 30 |
| 48 | 12 | 9·806254 | 6 15 | 10·193746 | 9·920733 | 6 26 | 10·079267 | 10·114478 | 6 11 | 9·885522 | 48 | 12 |
| 30 | 14 | 9·806330 | 7 18 | 10·193670 | 9·920861 | 7 30 | 10·079139 | 10·114531 | 7 12 | 9·885469 | 46 | 30 |
| 49 | 16 | 9·806406 | 8 20 | 10·193594 | 9·920990 | 8 34 | 10·079010 | 10·114584 | 8 14 | 9·885416 | 44 | 11 |
| 30 | 18 | 9·806482 | 9 23 | 10·193518 | 9·921118 | 9 39 | 10·078882 | 10·114636 | 9 16 | 9·885364 | 42 | 30 |
| 50 | 20 | 9·806557 | 10 25 | 10·193443 | 9·921247 | 10 43 | 10·078753 | 10·114689 | 10 18 | 9·885311 | 40 | 10 |
| 30 | 22 | 9·806633 | 11 28 | 10·193367 | 9·921375 | 11 47 | 10·078625 | 10·114742 | 11 20 | 9·885258 | 38 | 30 |
| 51 | 24 | 9·806709 | 12 30 | 10·193291 | 9·921503 | 12 51 | 10·078497 | 10·114795 | 12 21 | 9·885205 | 36 | 9 |
| 30 | 26 | 9·806785 | 13 33 | 10·193215 | 9·921632 | 13 56 | 10·078368 | 10·114847 | 13 23 | 9·885153 | 34 | 30 |
| 52 | 28 | 9·806860 | 14 35 | 10·193140 | 9·921760 | 14 60 | 10·078240 | 10·114900 | 14 25 | 9·885100 | 32 | 8 |
| 30 | 30 | 9·806936 | 15 38 | 10·193064 | 9·921889 | 15 64 | 10·078111 | 10·114953 | 15 26 | 9·885047 | 30 | 30 |
| 53 | 32 | 9·807011 | 16 40 | 10·192989 | 9·922017 | 16 68 | 10·077983 | 10·115006 | 16 28 | 9·884994 | 28 | 7 |
| 30 | 34 | 9·807087 | 17 43 | 10·192913 | 9·922145 | 17 73 | 10·077855 | 10·115058 | 17 30 | 9·884942 | 26 | 30 |
| 54 | 36 | 9·807163 | 18 45 | 10·192837 | 9·922274 | 18 77 | 10·077726 | 10·115111 | 18 32 | 9·884889 | 24 | 6 |
| 30 | 38 | 9·807238 | 19 48 | 10·192762 | 9·922402 | 19 81 | 10·077598 | 10·115164 | 19 33 | 9·884836 | 22 | 30 |
| 55 | 40 | 9·807314 | 20 50 | 10·192686 | 9·922530 | 20 86 | 10·077470 | 10·115217 | 20 35 | 9·884783 | 20 | 5 |
| 30 | 42 | 9·807389 | 21 53 | 10·192611 | 9·922659 | 21 90 | 10·077341 | 10·115270 | 21 37 | 9·884730 | 18 | 30 |
| 56 | 44 | 9·807465 | 22 55 | 10·192535 | 9·922787 | 22 94 | 10·077213 | 10·115323 | 22 39 | 9·884677 | 16 | 4 |
| 30 | 46 | 9·807540 | 23 58 | 10·192460 | 9·922915 | 23 98 | 10·077085 | 10·115375 | 23 40 | 9·884625 | 14 | 30 |
| 57 | 48 | 9·807615 | 24 60 | 10·192385 | 9·923044 | 24 103 | 10·076956 | 10·115428 | 24 42 | 9·884572 | 12 | 3 |
| 30 | 50 | 9·807691 | 25 63 | 10·192309 | 9·923172 | 25 107 | 10·076828 | 10·115481 | 25 44 | 9·884519 | 10 | 30 |
| 58 | 52 | 9·807766 | 26 65 | 10·192234 | 9·923300 | 26 111 | 10·076700 | 10·115534 | 26 46 | 9·884466 | 8 | 2 |
| 30 | 54 | 9·807842 | 27 68 | 10·192158 | 9·923429 | 27 116 | 10·076571 | 10·115587 | 27 48 | 9·884413 | 6 | 30 |
| 59 | 56 | 9·807917 | 28 70 | 10·192083 | 9·923557 | 28 120 | 10·076443 | 10·115640 | 28 49 | 9·884360 | 4 | 1 |
| 30 | 58 | 9·807992 | 29 73 | 10·192008 | 9·923685 | 29 124 | 10·076315 | 10·115693 | 29 51 | 9·884307 | 2 | 30 |
| 60 | **40** | 9·808067 | 30 76 | 10·191933 | 9·923814 | 30 128 | 10·076186 | 10·115746 | 30 53 | 9·884254 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

50° — 3h 20m

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$2^h\ 40^m$ — 40°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·808067 | | 10·191933 | 9·923814 | | 10·076186 | 10·115746 | | 9·884254 | **20** | 60 |
| 30 | 2 | 9·808143 | 1″ 3 | 10·191857 | 9·923942 | 1″ 4 | 10·076058 | 10·115799 | 1″ 2 | 9·884201 | 58 | 30 |
| 1 | 4 | 9·808218 | 2 5 | 10·191782 | 9·924070 | 2 9 | 10·075930 | 10·115852 | 2 4 | 9·884148 | 56 | 59 |
| 30 | 6 | 9·808293 | 3 8 | 10·191707 | 9·924198 | 3 13 | 10·075802 | 10·115905 | 3 5 | 9·884095 | 54 | 30 |
| 2 | 8 | 9·808368 | 4 10 | 10·191632 | 9·924327 | 4 17 | 10·075673 | 10·115958 | 4 7 | 9·884042 | 52 | 58 |
| 30 | 10 | 9·808444 | 5 13 | 10·191556 | 9·924455 | 5 21 | 10·075545 | 10·116011 | 5 9 | 9·883989 | 50 | 30 |
| 3 | 12 | 9·808519 | 6 15 | 10·191481 | 9·924583 | 6 26 | 10·075417 | 10·116064 | 6 11 | 9·883936 | 48 | 57 |
| 30 | 14 | 9·808594 | 7 18 | 10·191406 | 9·924711 | 7 30 | 10·075289 | 10·116117 | 7 12 | 9·883883 | 46 | 30 |
| 4 | 16 | 9·808669 | 8 20 | 10·191331 | 9·924840 | 8 34 | 10·075160 | 10·116171 | 8 14 | 9·883829 | 44 | 56 |
| 30 | 18 | 9·808744 | 9 23 | 10·191256 | 9·924968 | 9 38 | 10·075032 | 10·116224 | 9 16 | 9·883776 | 42 | 30 |
| 5 | 20 | 9·808819 | 10 25 | 10·191181 | 9·925096 | 10 43 | 10·074904 | 10·116277 | 10 18 | 9·883723 | 40 | 55 |
| 30 | 22 | 9·808894 | 11 28 | 10·191106 | 9·925224 | 11 47 | 10·074776 | 10·116330 | 11 19 | 9·883670 | 38 | 30 |
| 6 | 24 | 9·808969 | 12 30 | 10·191031 | 9·925352 | 12 51 | 10·074648 | 10·116383 | 12 21 | 9·883617 | 36 | 54 |
| 30 | 26 | 9·809044 | 13 33 | 10·190956 | 9·925481 | 13 56 | 10·074519 | 10·116436 | 13 23 | 9·883564 | 34 | 30 |
| 7 | 28 | 9·809119 | 14 35 | 10·190881 | 9·925609 | 14 60 | 10·074391 | 10·116490 | 14 25 | 9·883510 | 32 | 53 |
| 30 | 30 | 9·809194 | 15 38 | 10·190806 | 9·925737 | 15 64 | 10·074263 | 10·116543 | 15 27 | 9·883457 | 30 | 30 |
| 8 | 32 | 9·809269 | 16 40 | 10·190731 | 9·925865 | 16 68 | 10·074135 | 10·116596 | 16 28 | 9·883404 | 28 | 52 |
| 30 | 34 | 9·809344 | 17 43 | 10·190656 | 9·925993 | 17 73 | 10·074007 | 10·116649 | 17 30 | 9·883351 | 26 | 30 |
| 9 | 36 | 9·809419 | 18 45 | 10·190581 | 9·926122 | 18 77 | 10·073878 | 10·116703 | 18 32 | 9·883297 | 24 | 51 |
| 30 | 38 | 9·809494 | 19 48 | 10·190506 | 9·926250 | 19 81 | 10·073750 | 10·116756 | 19 34 | 9·883244 | 22 | 30 |
| 10 | 40 | 9·809569 | 20 50 | 10·190431 | 9·926378 | 20 85 | 10·073622 | 10·116809 | 20 35 | 9·883191 | 20 | 50 |
| 30 | 42 | 9·809643 | 21 53 | 10·190357 | 9·926506 | 21 90 | 10·073494 | 10·116863 | 21 37 | 9·883137 | 18 | 30 |
| 11 | 44 | 9·809718 | 22 55 | 10·190282 | 9·926634 | 22 94 | 10·073366 | 10·116916 | 22 39 | 9·883084 | 16 | 49 |
| 30 | 46 | 9·809793 | 23 58 | 10·190207 | 9·926762 | 23 98 | 10·073238 | 10·116969 | 23 41 | 9·883031 | 14 | 30 |
| 12 | 48 | 9·809868 | 24 60 | 10·190132 | 9·926890 | 24 102 | 10·073110 | 10·117023 | 24 42 | 9·882977 | 12 | 48 |
| 30 | 50 | 9·809943 | 25 63 | 10·190057 | 9·927019 | 25 107 | 10·072981 | 10·117076 | 25 44 | 9·882924 | 10 | 30 |
| 13 | 52 | 9·810017 | 26 65 | 10·189983 | 9·927147 | 26 111 | 10·072853 | 10·117129 | 26 46 | 9·882871 | 8 | 47 |
| 30 | 54 | 9·810092 | 27 68 | 10·189908 | 9·927275 | 27 115 | 10·072725 | 10·117183 | 27 48 | 9·882817 | 6 | 30 |
| 14 | 56 | 9·810167 | 28 70 | 10·189833 | 9·927403 | 28 120 | 10·072597 | 10·117236 | 28 50 | 9·882764 | 4 | 46 |
| 30 | 58 | 9·810241 | 29 73 | 10·189759 | 9·927531 | 29 124 | 10·072469 | 10·117290 | 29 51 | 9·882710 | 2 | 30 |
| 15 | **41** | 9·810316 | 30 75 | 10·189684 | 9·927659 | 30 128 | 10·072341 | 10·117343 | 30 53 | 9·882657 | **19** | 45 |
| 30 | 2 | 9·810390 | 1 2 | 10·189610 | 9·927787 | 1 4 | 10·072213 | 10·117397 | 1 2 | 9·882603 | 58 | 30 |
| 16 | 4 | 9·810465 | 2 5 | 10·189535 | 9·927915 | 2 9 | 10·072085 | 10·117450 | 2 4 | 9·882550 | 56 | 44 |
| 30 | 6 | 9·810540 | 3 7 | 10·189460 | 9·928043 | 3 13 | 10·071957 | 10·117504 | 3 5 | 9·882496 | 54 | 30 |
| 17 | 8 | 9·810614 | 4 10 | 10·189386 | 9·928171 | 4 17 | 10·071829 | 10·117557 | 4 7 | 9·882443 | 52 | 43 |
| 30 | 10 | 9·810689 | 5 12 | 10·189311 | 9·928299 | 5 21 | 10·071701 | 10·117611 | 5 9 | 9·882389 | 50 | 30 |
| 18 | 12 | 9·810763 | 6 15 | 10·189237 | 9·928427 | 6 26 | 10·071573 | 10·117664 | 6 11 | 9·882336 | 48 | 42 |
| 30 | 14 | 9·810838 | 7 17 | 10·189162 | 9·928555 | 7 30 | 10·071445 | 10·117718 | 7 13 | 9·882282 | 46 | 30 |
| 19 | 16 | 9·810912 | 8 20 | 10·189088 | 9·928684 | 8 34 | 10·071316 | 10·117771 | 8 14 | 9·882229 | 41 | 41 |
| 30 | 18 | 9·810986 | 9 22 | 10·189014 | 9·928812 | 9 38 | 10·071188 | 10·117825 | 9 16 | 9·882175 | 42 | 30 |
| 20 | 20 | 9·811061 | 10 25 | 10·188939 | 9·928940 | 10 43 | 10·071060 | 10·117879 | 10 18 | 9·882121 | 40 | 40 |
| 30 | 22 | 9·811135 | 11 27 | 10·188865 | 9·929068 | 11 47 | 10·070932 | 10·117932 | 11 20 | 9·882068 | 38 | 30 |
| 21 | 24 | 9·811210 | 12 30 | 10·188790 | 9·929196 | 12 51 | 10·070804 | 10·117986 | 12 21 | 9·882014 | 36 | 39 |
| 30 | 26 | 9·811284 | 13 32 | 10·188716 | 9·929324 | 13 55 | 10·070676 | 10·118040 | 13 23 | 9·881960 | 34 | 30 |
| 22 | 28 | 9·811358 | 14 35 | 10·188642 | 9·929452 | 14 60 | 10·070548 | 10·118093 | 14 25 | 9·881907 | 32 | 38 |
| 30 | 30 | 9·811433 | 15 37 | 10·188567 | 9·929580 | 15 64 | 10·070420 | 10·118147 | 15 27 | 9·881853 | 30 | 30 |
| 23 | 32 | 9·811507 | 16 40 | 10·188493 | 9·929708 | 16 68 | 10·070292 | 10·118201 | 16 29 | 9·881799 | 28 | 37 |
| 30 | 34 | 9·811581 | 17 42 | 10·188419 | 9·929836 | 17 73 | 10·070164 | 10·118254 | 17 30 | 9·881746 | 26 | 30 |
| 24 | 36 | 9·811655 | 18 45 | 10·188345 | 9·929964 | 18 77 | 10·070036 | 10·118308 | 18 32 | 9·881692 | 24 | 36 |
| 30 | 38 | 9·811730 | 19 47 | 10·188270 | 9·930092 | 19 81 | 10·069908 | 10·118362 | 19 34 | 9·881638 | 22 | 30 |
| 25 | 40 | 9·811804 | 20 50 | 10·188196 | 9·930220 | 20 85 | 10·069780 | 10·118416 | 20 36 | 9·881584 | 20 | 35 |
| 30 | 42 | 9·811878 | 21 52 | 10·188122 | 9·930348 | 21 90 | 10·069652 | 10·118470 | 21 38 | 9·881530 | 18 | 30 |
| 26 | 44 | 9·811952 | 22 55 | 10·188048 | 9·930475 | 22 94 | 10·069525 | 10·118523 | 22 39 | 9·881477 | 16 | 34 |
| 30 | 46 | 9·812026 | 23 57 | 10·187974 | 9·930603 | 23 98 | 10·069397 | 10·118577 | 23 41 | 9·881423 | 14 | 30 |
| 27 | 48 | 9·812100 | 24 60 | 10·187900 | 9·930731 | 24 102 | 10·069269 | 10·118631 | 24 43 | 9·881369 | 12 | 33 |
| 30 | 50 | 9·812174 | 25 62 | 10·187826 | 9·930859 | 25 107 | 10·069141 | 10·118685 | 25 45 | 9·881315 | 10 | 30 |
| 28 | 52 | 9·812248 | 26 65 | 10·187752 | 9·930987 | 26 111 | 10·069013 | 10·118739 | 26 47 | 9·881261 | 8 | 32 |
| 30 | 54 | 9·812322 | 27 67 | 10·187678 | 9·931115 | 27 115 | 10·068885 | 10·118793 | 27 48 | 9·881207 | 6 | 30 |
| 29 | 56 | 9·812396 | 28 70 | 10·187604 | 9·931243 | 28 119 | 10·068757 | 10·118847 | 28 50 | 9·881153 | 4 | 31 |
| 30 | 58 | 9·812470 | 29 72 | 10·187530 | 9·931371 | 29 124 | 10·068629 | 10·118901 | 29 52 | 9·881099 | 2 | 30 |
| 30 | **42** | 9·812544 | 30 74 | 10·187456 | 9·931499 | 30 128 | 10·068501 | 10·118954 | 30 54 | 9·881046 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

49° — $3^h\ 18^m$

## TABLE XXVI.—(continued).

### LOG. SINES, COSINES, &c.

2h 42m — 40°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·812544 | | 10·187456 | 9·931499 | | 10·068501 | 10·118954 | | 9·881046 | 18 | 30 |
| 30 | 2 | 9·812618 | 1″ 2 | 10·187382 | 9·931627 | 1″ 4 | 10·068373 | 10·119008 | 1″ 2 | 9·880992 | 58 | 30 |
| 31 | 4 | 9·812692 | 2 5 | 10·187308 | 9·931755 | 2 9 | 10·068245 | 10·119062 | 2 4 | 9·880938 | 56 | 29 |
| 30 | 6 | 9·812766 | 3 7 | 10·187234 | 9·931883 | 3 13 | 10·068117 | 10·119116 | 3 5 | 9·880884 | 54 | 30 |
| 32 | 8 | 9·812840 | 4 10 | 10·187160 | 9·932010 | 4 17 | 10·067990 | 10·119170 | 4 7 | 9·880830 | 52 | 28 |
| 30 | 10 | 9·812914 | 5 12 | 10·187086 | 9·932138 | 5 21 | 10·067862 | 10·119224 | 5 9 | 9·880776 | 50 | 30 |
| 33 | 12 | 9·812988 | 6 15 | 10·187012 | 9·932266 | 6 26 | 10·067734 | 10·119278 | 6 11 | 9·880722 | 48 | 27 |
| 30 | 14 | 9·813062 | 7 17 | 10·186938 | 9·932394 | 7 30 | 10·067606 | 10·119333 | 7 13 | 9·880667 | 46 | 30 |
| 34 | 16 | 9·813135 | 8 20 | 10·186865 | 9·932522 | 8 34 | 10·067478 | 10·119387 | 8 14 | 9·880613 | 44 | 26 |
| 30 | 18 | 9·813209 | 9 22 | 10·186791 | 9·932650 | 9 38 | 10·067350 | 10·119441 | 9 16 | 9·880559 | 42 | 30 |
| 35 | 20 | 9·813283 | 10 24 | 10·186717 | 9·932778 | 10 43 | 10·067222 | 10·119495 | 10 18 | 9·880505 | 40 | 25 |
| 30 | 22 | 9·813357 | 11 27 | 10·186643 | 9·932906 | 11 47 | 10·067094 | 10·119549 | 11 20 | 9·880451 | 38 | 30 |
| 36 | 24 | 9·813430 | 12 29 | 10·186570 | 9·933033 | 12 51 | 10·066967 | 10·119603 | 12 22 | 9·880397 | 36 | 24 |
| 30 | 26 | 9·813504 | 13 32 | 10·186496 | 9·933161 | 13 55 | 10·066839 | 10·119657 | 13 24 | 9·880343 | 34 | 30 |
| 37 | 28 | 9·813578 | 14 34 | 10·186422 | 9·933289 | 14 60 | 10·066711 | 10·119711 | 14 25 | 9·880289 | 32 | 23 |
| 30 | 30 | 9·813651 | 15 37 | 10·186349 | 9·933417 | 15 64 | 10·066583 | 10·119766 | 15 27 | 9·880234 | 30 | 30 |
| 38 | 32 | 9·813725 | 16 39 | 10·186275 | 9·933545 | 16 68 | 10·066455 | 10·119820 | 16 29 | 9·880180 | 28 | 22 |
| 30 | 34 | 9·813799 | 17 42 | 10·186201 | 9·933672 | 17 72 | 10·066328 | 10·119874 | 17 31 | 9·880126 | 26 | 30 |
| 39 | 36 | 9·813872 | 18 44 | 10·186128 | 9·933800 | 18 77 | 10·066200 | 10·119928 | 18 32 | 9·880072 | 24 | 21 |
| 30 | 38 | 9·813946 | 19 47 | 10·186054 | 9·933928 | 19 81 | 10·066072 | 10·119982 | 19 34 | 9·880018 | 22 | 30 |
| 40 | 40 | 9·814019 | 20 49 | 10·185981 | 9·934056 | 20 85 | 10·065944 | 10·120037 | 20 36 | 9·879963 | 20 | 20 |
| 30 | 42 | 9·814093 | 21 51 | 10·185907 | 9·934184 | 21 89 | 10·065816 | 10·120091 | 21 38 | 9·879909 | 18 | 30 |
| 41 | 44 | 9·814166 | 22 54 | 10·185834 | 9·934311 | 22 94 | 10·065689 | 10·120145 | 22 40 | 9·879855 | 16 | 19 |
| 30 | 46 | 9·814240 | 23 56 | 10·185760 | 9·934439 | 23 98 | 10·065561 | 10·120200 | 23 42 | 9·879800 | 14 | 30 |
| 42 | 48 | 9·814313 | 24 59 | 10·185687 | 9·934567 | 24 102 | 10·065433 | 10·120254 | 24 43 | 9·879746 | 12 | 18 |
| 30 | 50 | 9·814387 | 25 61 | 10·185613 | 9·934695 | 25 106 | 10·065305 | 10·120308 | 25 45 | 9·879692 | 10 | 30 |
| 43 | 52 | 9·814460 | 26 64 | 10·185540 | 9·934822 | 26 111 | 10·065178 | 10·120363 | 26 47 | 9·879637 | 8 | 17 |
| 30 | 54 | 9·814533 | 27 66 | 10·185467 | 9·934950 | 27 115 | 10·065050 | 10·120417 | 27 49 | 9·879583 | 6 | 30 |
| 44 | 56 | 9·814607 | 28 69 | 10·185393 | 9·935078 | 28 119 | 10·064922 | 10·120471 | 28 51 | 9·879529 | 4 | 16 |
| 30 | 58 | 9·814680 | 29 71 | 10·185320 | 9·935206 | 29 124 | 10·064794 | 10·120526 | 29 52 | 9·879474 | 2 | 30 |
| 45 | **43** | 9·814753 | 30 74 | 10·185247 | 9·935333 | 30 128 | 10·064667 | 10·120580 | 30 54 | 9·879420 | **17** | 15 |
| 30 | 2 | 9·814827 | 1 2 | 10·185173 | 9·935461 | 1 4 | 10·064539 | 10·120635 | 1 2 | 9·879365 | 58 | 30 |
| 46 | 4 | 9·814900 | 2 5 | 10·185100 | 9·935589 | 2 9 | 10·064411 | 10·120689 | 2 4 | 9·879311 | 56 | 14 |
| 30 | 6 | 9·814973 | 3 7 | 10·185027 | 9·935717 | 3 13 | 10·064283 | 10·120743 | 3 5 | 9·879257 | 54 | 30 |
| 47 | 8 | 9·815046 | 4 10 | 10·184954 | 9·935844 | 4 17 | 10·064156 | 10·120798 | 4 7 | 9·879202 | 52 | 13 |
| 30 | 10 | 9·815120 | 5 12 | 10·184880 | 9·935972 | 5 21 | 10·064028 | 10·120852 | 5 9 | 9·879148 | 50 | 30 |
| 48 | 12 | 9·815193 | 6 15 | 10·184807 | 9·936100 | 6 26 | 10·063900 | 10·120907 | 6 11 | 9·879093 | 48 | 12 |
| 30 | 14 | 9·815266 | 7 17 | 10·184734 | 9·936227 | 7 30 | 10·063773 | 10·120961 | 7 13 | 9·879039 | 46 | 30 |
| 49 | 16 | 9·815339 | 8 20 | 10·184661 | 9·936355 | 8 34 | 10·063645 | 10·121016 | 8 15 | 9·878984 | 44 | 11 |
| 30 | 18 | 9·815412 | 9 22 | 10·184588 | 9·936483 | 9 38 | 10·063517 | 10·121071 | 9 16 | 9·878929 | 42 | 30 |
| 50 | 20 | 9·815485 | 10 24 | 10·184515 | 9·936611 | 10 43 | 10·063389 | 10·121125 | 10 18 | 9·878875 | 40 | 10 |
| 30 | 22 | 9·815558 | 11 27 | 10·184442 | 9·936738 | 11 47 | 10·063262 | 10·121180 | 11 20 | 9·878820 | 38 | 30 |
| 51 | 24 | 9·815632 | 12 29 | 10·184368 | 9·936866 | 12 51 | 10·063134 | 10·121234 | 12 22 | 9·878766 | 36 | 9 |
| 30 | 26 | 9·815705 | 13 32 | 10·184295 | 9·936994 | 13 55 | 10·063006 | 10·121289 | 13 24 | 9·878711 | 34 | 30 |
| 52 | 28 | 9·815778 | 14 34 | 10·184222 | 9·937121 | 14 60 | 10·062879 | 10·121344 | 14 25 | 9·878656 | 32 | 8 |
| 30 | 30 | 9·815851 | 15 36 | 10·184149 | 9·937249 | 15 64 | 10·062751 | 10·121398 | 15 27 | 9·878602 | 30 | 30 |
| 53 | 32 | 9·815924 | 16 39 | 10·184076 | 9·937377 | 16 68 | 10·062623 | 10·121453 | 16 29 | 9·878547 | 28 | 7 |
| 30 | 34 | 9·815996 | 17 41 | 10·184004 | 9·937504 | 17 72 | 10·062496 | 10·121508 | 17 31 | 9·878492 | 26 | 30 |
| 54 | 36 | 9·816069 | 18 44 | 10·183931 | 9·937632 | 18 77 | 10·062368 | 10·121562 | 18 33 | 9·878438 | 24 | 6 |
| 30 | 38 | 9·816142 | 19 46 | 10·183858 | 9·937759 | 19 81 | 10·062241 | 10·121617 | 19 35 | 9·878383 | 22 | 30 |
| 55 | 40 | 9·816215 | 20 49 | 10·183785 | 9·937887 | 20 85 | 10·062113 | 10·121672 | 20 36 | 9·878328 | 20 | 5 |
| 30 | 42 | 9·816288 | 21 51 | 10·183712 | 9·938015 | 21 89 | 10·061985 | 10·121727 | 21 38 | 9·878273 | 18 | 30 |
| 56 | 44 | 9·816361 | 22 54 | 10·183639 | 9·938142 | 22 94 | 10·061858 | 10·121781 | 22 40 | 9·878219 | 16 | 4 |
| 30 | 46 | 9·816434 | 23 56 | 10·183566 | 9·938270 | 23 98 | 10·061730 | 10·121836 | 23 42 | 9·878164 | 14 | 30 |
| 57 | 48 | 9·816507 | 24 58 | 10·183493 | 9·938398 | 24 102 | 10·061602 | 10·121891 | 24 44 | 9·878109 | 12 | 3 |
| 30 | 50 | 9·816579 | 25 61 | 10·183421 | 9·938525 | 25 106 | 10·061475 | 10·121946 | 25 46 | 9·878054 | 10 | 30 |
| 58 | 52 | 9·816652 | 26 63 | 10·183348 | 9·938653 | 26 111 | 10·061347 | 10·122001 | 26 47 | 9·877999 | 8 | 2 |
| 30 | 54 | 9·816725 | 27 66 | 10·183275 | 9·938780 | 27 115 | 10·061220 | 10·122055 | 27 49 | 9·877945 | 6 | 30 |
| 59 | 56 | 9·816798 | 28 68 | 10·183202 | 9·938908 | 28 119 | 10·061092 | 10·122110 | 28 51 | 9·877890 | 4 | 1 |
| 30 | 58 | 9·816870 | 29 70 | 10·183130 | 9·939035 | 29 123 | 10·060965 | 10·122165 | 29 53 | 9·877835 | 2 | 30 |
| 60 | **44** | 9·816943 | 30 73 | 10·183057 | 9·939163 | 30 128 | 10·060837 | 10·122220 | 30 55 | 9·877780 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |

49° — 3h 18m

TABLE XXVI.—(*continued*)

LOG. SINES, COSINES, &c.

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2h 44m | | | | | 41° | | | | | | | |
| 0 | 0 | 9·816943 | | 10·183057 | 9·939163 | | 10·060837 | 10·122220 | | 9·877780 | 16 | 60 |
| 30 | 2 | 9·817016 | 1″ 2 | 10·182984 | 9·939291 | 1″ 4 | 10·060709 | 10·122275 | 1″ 2 | 9·877725 | 58 | 30 |
| 1 | 4 | 9·817088 | 2 5 | 10·182912 | 9·939418 | 2 8 | 10·060582 | 10·122330 | 2 4 | 9·877670 | 56 | 59 |
| 30 | 6 | 9·817161 | 3 7 | 10·182839 | 9·939546 | 3 13 | 10·060454 | 10·122385 | 3 5 | 9·877615 | 54 | 30 |
| 2 | 8 | 9·817233 | 4 10 | 10·182767 | 9·939673 | 4 17 | 10·060327 | 10·122440 | 4 7 | 9·877560 | 52 | 58 |
| 30 | 10 | 9·817306 | 5 12 | 10·182694 | 9·939801 | 5 21 | 10·060199 | 10·122495 | 5 9 | 9·877505 | 50 | 30 |
| 3 | 12 | 9·817379 | 6 14 | 10·182621 | 9·939928 | 6 25 | 10·060072 | 10·122550 | 6 11 | 9·877450 | 48 | 57 |
| 30 | 14 | 9·817451 | 7 17 | 10·182549 | 9·940056 | 7 30 | 10·059944 | 10·122605 | 7 13 | 9·877395 | 46 | 30 |
| 4 | 16 | 9·817524 | 8 19 | 10·182476 | 9·940183 | 8 34 | 10·059817 | 10·122660 | 8 15 | 9·877340 | 44 | 56 |
| 30 | 18 | 9·817596 | 9 22 | 10·182404 | 9·940311 | 9 38 | 10·059689 | 10·122715 | 9 16 | 9·877285 | 42 | 30 |
| 5 | 20 | 9·817668 | 10 24 | 10·182332 | 9·940439 | 10 42 | 10·059561 | 10·122770 | 10 18 | 9·877230 | 40 | 55 |
| 30 | 22 | 9·817741 | 11 27 | 10·182259 | 9·940566 | 11 47 | 10·059434 | 10·122825 | 11 20 | 9·877175 | 38 | 30 |
| 6 | 24 | 9·817813 | 12 29 | 10·182187 | 9·940694 | 12 51 | 10·059306 | 10·122880 | 12 22 | 9·877120 | 36 | 54 |
| 30 | 26 | 9·817886 | 13 32 | 10·182114 | 9·940821 | 13 55 | 10·059179 | 10·122935 | 13 24 | 9·877065 | 34 | 30 |
| 7 | 28 | 9·817958 | 14 34 | 10·182042 | 9·940949 | 14 59 | 10·059051 | 10·122990 | 14 26 | 9·877010 | 32 | 53 |
| 30 | 30 | 9·818030 | 15 36 | 10·181970 | 9·941076 | 15 64 | 10·058924 | 10·123046 | 15 27 | 9·876954 | 30 | 30 |
| 8 | 32 | 9·818103 | 16 39 | 10·181897 | 9·941204 | 16 68 | 10·058796 | 10·123101 | 16 29 | 9·876899 | 28 | 52 |
| 30 | 34 | 9·818175 | 17 41 | 10·181825 | 9·941331 | 17 72 | 10·058669 | 10·123156 | 17 31 | 9·876844 | 26 | 30 |
| 9 | 36 | 9·818247 | 18 43 | 10·181753 | 9·941459 | 18 76 | 10·058541 | 10·123211 | 18 33 | 9·876789 | 24 | 51 |
| 30 | 38 | 9·818320 | 19 46 | 10·181680 | 9·941586 | 19 81 | 10·058414 | 10·123266 | 19 35 | 9·876734 | 22 | 30 |
| 10 | 40 | 9·818392 | 20 48 | 10·181608 | 9·941713 | 20 85 | 10·058287 | 10·123322 | 20 37 | 9·876678 | 20 | 50 |
| 30 | 42 | 9·818464 | 21 51 | 10·181536 | 9·941841 | 21 89 | 10·058159 | 10·123377 | 21 38 | 9·876623 | 18 | 30 |
| 11 | 44 | 9·818536 | 22 53 | 10·181464 | 9·941968 | 22 93 | 10·058032 | 10·123432 | 22 40 | 9·876568 | 16 | 49 |
| 30 | 46 | 9·818609 | 23 56 | 10·181391 | 9·942096 | 23 98 | 10·057904 | 10·123487 | 23 42 | 9·876513 | 14 | 30 |
| 12 | 48 | 9·818681 | 24 58 | 10·181319 | 9·942223 | 24 102 | 10·057777 | 10·123543 | 24 44 | 9·876457 | 12 | 48 |
| 30 | 50 | 9·818753 | 25 61 | 10·181247 | 9·942351 | 25 106 | 10·057649 | 10·123598 | 25 46 | 9·876402 | 10 | 30 |
| 13 | 52 | 9·818825 | 26 63 | 10·181175 | 9·942478 | 26 110 | 10·057522 | 10·123653 | 26 48 | 9·876347 | 8 | 47 |
| 30 | 54 | 9·818897 | 27 65 | 10·181103 | 9·942606 | 27 115 | 10·057394 | 10·123709 | 27 49 | 9·876201 | 6 | 30 |
| 14 | 56 | 9·818969 | 28 68 | 10·181031 | 9·942733 | 28 119 | 10·057267 | 10·123764 | 28 51 | 9·876236 | 4 | 46 |
| 30 | 58 | 9·819041 | 29 70 | 10·180959 | 9·942861 | 29 123 | 10·057139 | 10·123819 | 29 53 | 9·876181 | 2 | 30 |
| 15 | 45 | 9·819113 | 30 72 | 10·180887 | 9·942988 | 30 127 | 10·057012 | 10·123875 | 30 55 | 9·876125 | 15 | 45 |
| 30 | 2 | 9·819185 | 1 2 | 10·180815 | 9·943115 | 1 4 | 10·056885 | 10·123930 | 1 2 | 9·876070 | 58 | 30 |
| 16 | 4 | 9·819257 | 2 5 | 10·180743 | 9·943243 | 2 8 | 10·056757 | 10·123986 | 2 4 | 9·876014 | 56 | 44 |
| 30 | 6 | 9·819329 | 3 7 | 10·180671 | 9·943370 | 3 13 | 10·056630 | 10·124041 | 3 6 | 9·875959 | 54 | 30 |
| 17 | 8 | 9·819401 | 4 10 | 10·180599 | 9·943498 | 4 17 | 10·056502 | 10·124096 | 4 7 | 9·875904 | 52 | 43 |
| 30 | 10 | 9·819473 | 5 12 | 10·180527 | 9·943625 | 5 21 | 10·056375 | 10·124152 | 5 9 | 9·875848 | 50 | 30 |
| 18 | 12 | 9·819545 | 6 14 | 10·180455 | 9·943752 | 6 25 | 10·056248 | 10·124207 | 6 11 | 9·875793 | 48 | 42 |
| 30 | 14 | 9·819617 | 7 17 | 10·180383 | 9·943880 | 7 30 | 10·056120 | 10·124263 | 7 13 | 9·875737 | 46 | 30 |
| 19 | 16 | 9·819689 | 8 19 | 10·180311 | 9·944007 | 8 34 | 10·055993 | 10·124318 | 8 15 | 9·875682 | 44 | 41 |
| 30 | 18 | 9·819761 | 9 22 | 10·180239 | 9·944135 | 9 38 | 10·055865 | 10·124374 | 9 17 | 9·875626 | 42 | 30 |
| 20 | 20 | 9·819832 | 10 24 | 10·180168 | 9·944262 | 10 42 | 10·055738 | 10·124429 | 10 19 | 9·875571 | 40 | 40 |
| 30 | 22 | 9·819904 | 11 26 | 10·180096 | 9·944389 | 11 47 | 10·055611 | 10·124485 | 11 20 | 9·875515 | 38 | 30 |
| 21 | 24 | 9·819976 | 12 29 | 10·180024 | 9·944517 | 12 51 | 10·055483 | 10·124541 | 12 22 | 9·875459 | 36 | 39 |
| 30 | 26 | 9·820048 | 13 31 | 10·179952 | 9·944644 | 13 55 | 10·055356 | 10·124596 | 13 24 | 9·875404 | 34 | 30 |
| 22 | 28 | 9·820120 | 14 34 | 10·179880 | 9·944771 | 14 59 | 10·055229 | 10·124652 | 14 26 | 9·875348 | 32 | 38 |
| 30 | 30 | 9·820191 | 15 36 | 10·179809 | 9·944899 | 15 64 | 10·055101 | 10·124707 | 15 28 | 9·875293 | 30 | 30 |
| 23 | 32 | 9·820263 | 16 38 | 10·179737 | 9·945026 | 16 68 | 10·054974 | 10·124763 | 16 30 | 9·875237 | 28 | 37 |
| 30 | 34 | 9·820335 | 17 41 | 10·179665 | 9·945153 | 17 72 | 10·054847 | 10·124819 | 17 31 | 9·875181 | 26 | 30 |
| 24 | 36 | 9·820406 | 18 43 | 10·179594 | 9·945281 | 18 76 | 10·054719 | 10·124874 | 18 33 | 9·875126 | 24 | 36 |
| 30 | 38 | 9·820478 | 19 46 | 10·179522 | 9·945408 | 19 81 | 10·054592 | 10·124930 | 19 35 | 9·875070 | 22 | 30 |
| 25 | 40 | 9·820550 | 20 48 | 10·179450 | 9·945535 | 20 85 | 10·054465 | 10·124986 | 20 37 | 9·875014 | 20 | 35 |
| 30 | 42 | 9·820621 | 21 50 | 10·179379 | 9·945663 | 21 89 | 10·054337 | 10·125042 | 21 39 | 9·874958 | 18 | 30 |
| 26 | 44 | 9·820693 | 22 53 | 10·179307 | 9·945790 | 22 93 | 10·054210 | 10·125097 | 22 41 | 9·874903 | 16 | 34 |
| 30 | 46 | 9·820764 | 23 55 | 10·179236 | 9·945917 | 23 98 | 10·054083 | 10·125153 | 23 43 | 9·874847 | 14 | 30 |
| 27 | 48 | 9·820836 | 24 57 | 10·179164 | 9·946045 | 24 102 | 10·053955 | 10·125209 | 24 45 | 9·874791 | 12 | 33 |
| 30 | 50 | 9·820907 | 25 60 | 10·179093 | 9·946172 | 25 106 | 10·053828 | 10·125265 | 25 46 | 9·874735 | 10 | 30 |
| 28 | 52 | 9·820979 | 26 62 | 10·179021 | 9·946299 | 26 110 | 10·053701 | 10·125320 | 26 48 | 9·874680 | 8 | 32 |
| 30 | 54 | 9·821050 | 27 65 | 10·178950 | 9·946427 | 27 115 | 10·053573 | 10·125376 | 27 50 | 9·874624 | 6 | 30 |
| 29 | 56 | 9·821122 | 28 67 | 10·178878 | 9·946554 | 28 119 | 10·053446 | 10·125432 | 28 52 | 9·874568 | 4 | 31 |
| 30 | 58 | 9·821193 | 29 69 | 10·178807 | 9·946681 | 29 123 | 10·053319 | 10·125488 | 29 54 | 9·874512 | 2 | 30 |
| 30 | 46 | 9·821265 | 30 72 | 10·178735 | 9·946808 | 30 127 | 10·053192 | 10·125544 | 30 56 | 9·874456 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | 48° | | | | | 3h 14m | | |

## TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

$2^h\ 46^m$ — 41°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·821265 | | 10·178735 | 9·946808 | | 10·053192 | 10·125544 | | 9·874456 | **14** | 30 |
| 30 | 2 | 9·821336 | 1″ 2 | 10·178664 | 9·946936 | 1″ 4 | 10·053064 | 10·125600 | 1″ 2 | 9·874400 | 58 | 30 |
| 31 | 4 | 9·821407 | 2 5 | 10·178593 | 9·947063 | 2 8 | 10·052937 | 10·125656 | 2 4 | 9·874344 | 56 | 29 |
| 30 | 6 | 9·821479 | 3 7 | 10·178521 | 9·947190 | 3 13 | 10·052810 | 10·125712 | 3 6 | 9·874288 | 54 | 30 |
| 32 | 8 | 9·821550 | 4 10 | 10·178450 | 9·947318 | 4 17 | 10·052682 | 10·125768 | 4 7 | 9·874232 | 52 | 28 |
| 30 | 10 | 9·821621 | 5 12 | 10·178379 | 9·947445 | 5 21 | 10·052555 | 10·125823 | 5 9 | 9·874177 | 50 | 30 |
| 33 | 12 | 9·821693 | 6 14 | 10·178307 | 9·947572 | 6 25 | 10·052428 | 10·125879 | 6 11 | 9·874121 | 48 | 27 |
| 30 | 14 | 9·821764 | 7 17 | 10·178236 | 9·947699 | 7 30 | 10·052301 | 10·125935 | 7 13 | 9·874065 | 46 | 30 |
| 34 | 16 | 9·821835 | 8 19 | 10·178165 | 9·947827 | 8 34 | 10·052173 | 10·125991 | 8 15 | 9·874009 | 44 | 26 |
| 30 | 18 | 9·821906 | 9 21 | 10·178094 | 9·947954 | 9 38 | 10·052046 | 10·126047 | 9 17 | 9·873953 | 42 | 30 |
| 35 | 20 | 9·821977 | 10 24 | 10·178023 | 9·948081 | 10 42 | 10·051919 | 10·126104 | 10 19 | 9·873896 | 40 | 25 |
| 30 | 22 | 9·822049 | 11 26 | 10·177951 | 9·948208 | 11 47 | 10·051792 | 10·126160 | 11 21 | 9·873840 | 38 | 30 |
| 36 | 24 | 9·822120 | 12 28 | 10·177880 | 9·948335 | 12 51 | 10·051665 | 10·126216 | 12 22 | 9·873784 | 36 | 24 |
| 30 | 26 | 9·822191 | 13 31 | 10·177809 | 9·948463 | 13 55 | 10·051537 | 10·126272 | 13 24 | 9·873728 | 34 | 30 |
| 37 | 28 | 9·822262 | 14 33 | 10·177738 | 9·948590 | 14 59 | 10·051410 | 10·126328 | 14 26 | 9·873672 | 32 | 23 |
| 30 | 30 | 9·822333 | 15 36 | 10·177667 | 9·948717 | 15 64 | 10·051283 | 10·126384 | 15 28 | 9·873616 | 30 | 30 |
| 38 | 32 | 9·822404 | 16 38 | 10·177596 | 9·948844 | 16 68 | 10·051156 | 10·126440 | 16 30 | 9·873560 | 28 | 22 |
| 30 | 34 | 9·822475 | 17 40 | 10·177525 | 9·948972 | 17 72 | 10·051028 | 10·126496 | 17 32 | 9·873504 | 26 | 30 |
| 39 | 36 | 9·822546 | 18 43 | 10·177454 | 9·949099 | 18 76 | 10·050901 | 10·126552 | 18 34 | 9·873448 | 24 | 21 |
| 30 | 38 | 9·822617 | 19 45 | 10·177383 | 9·949226 | 19 81 | 10·050774 | 10·126609 | 19 36 | 9·873391 | 22 | 30 |
| 40 | 40 | 9·822688 | 20 47 | 10·177312 | 9·949353 | 20 85 | 10·050647 | 10·126665 | 20 37 | 9·873335 | 20 | 20 |
| 30 | 42 | 9·822759 | 21 50 | 10·177241 | 9·949480 | 21 89 | 10·050520 | 10·126721 | 21 39 | 9·873279 | 18 | 30 |
| 41 | 44 | 9·822830 | 22 52 | 10·177170 | 9·949608 | 22 93 | 10·050392 | 10·126777 | 22 41 | 9·873223 | 16 | 19 |
| 30 | 46 | 9·822901 | 23 55 | 10·177099 | 9·949735 | 23 98 | 10·050265 | 10·126834 | 23 43 | 9·873166 | 14 | 30 |
| 42 | 48 | 9·822972 | 24 57 | 10·177028 | 9·949862 | 24 102 | 10·050138 | 10·126890 | 24 45 | 9·873110 | 12 | 18 |
| 30 | 50 | 9·823043 | 25 59 | 10·176957 | 9·949989 | 25 106 | 10·050011 | 10·126946 | 25 47 | 9·873054 | 10 | 30 |
| 43 | 52 | 9·823114 | 26 62 | 10·176886 | 9·950116 | 26 110 | 10·049884 | 10·127002 | 26 49 | 9·872998 | 8 | 17 |
| 30 | 54 | 9·823185 | 27 64 | 10·176815 | 9·950243 | 27 114 | 10·049757 | 10·127059 | 27 50 | 9·872941 | 6 | 30 |
| 44 | 56 | 9·823255 | 28 66 | 10·176745 | 9·950371 | 28 119 | 10·049629 | 10·127115 | 28 52 | 9·872885 | 4 | 16 |
| 30 | 58 | 9·823326 | 29 69 | 10·176674 | 9·950498 | 29 123 | 10·049502 | 10·127171 | 29 54 | 9·872829 | 2 | 30 |
| 45 | **47** | 9·823397 | 30 71 | 10·176603 | 9·950625 | 30 127 | 10·049375 | 10·127228 | 30 56 | 9·872772 | **13** | 15 |
| 30 | 2 | 9·823468 | 1 2 | 10·176532 | 9·950752 | 1 4 | 10·049248 | 10·127284 | 1 2 | 9·872716 | 58 | 30 |
| 46 | 4 | 9·823539 | 2 5 | 10·176461 | 9·950879 | 2 8 | 10·049121 | 10·127341 | 2 4 | 9·872659 | 56 | 14 |
| 30 | 6 | 9·823609 | 3 7 | 10·176391 | 9·951006 | 3 13 | 10·048994 | 10·127397 | 3 6 | 9·872603 | 54 | 30 |
| 47 | 8 | 9·823680 | 4 9 | 10·176320 | 9·951133 | 4 17 | 10·048867 | 10·127453 | 4 8 | 9·872547 | 52 | 13 |
| 30 | 10 | 9·823751 | 5 12 | 10·176249 | 9·951261 | 5 21 | 10·048739 | 10·127510 | 5 9 | 9·872490 | 50 | 30 |
| 48 | 12 | 9·823821 | 6 14 | 10·176179 | 9·951388 | 6 25 | 10·048612 | 10·127566 | 6 11 | 9·872434 | 48 | 12 |
| 30 | 14 | 9·823892 | 7 16 | 10·176108 | 9·951515 | 7 30 | 10·048485 | 10·127623 | 7 13 | 9·872377 | 46 | 30 |
| 49 | 16 | 9·823963 | 8 19 | 10·176037 | 9·951642 | 8 34 | 10·048358 | 10·127679 | 8 15 | 9·872321 | 44 | 11 |
| 30 | 18 | 9·824033 | 9 21 | 10·175967 | 9·951769 | 9 38 | 10·048231 | 10·127736 | 9 17 | 9·872264 | 42 | 30 |
| 50 | 20 | 9·824104 | 10 23 | 10·175896 | 9·951896 | 10 42 | 10·048104 | 10·127792 | 10 19 | 9·872208 | 40 | 10 |
| 30 | 22 | 9·824174 | 11 26 | 10·175826 | 9·952023 | 11 47 | 10·047977 | 10·127849 | 11 21 | 9·872151 | 38 | 30 |
| 51 | 24 | 9·824245 | 12 28 | 10·175755 | 9·952150 | 12 51 | 10·047850 | 10·127905 | 12 23 | 9·872095 | 36 | 9 |
| 30 | 26 | 9·824315 | 13 30 | 10·175685 | 9·952277 | 13 55 | 10·047723 | 10·127962 | 13 25 | 9·872038 | 34 | 30 |
| 52 | 28 | 9·824386 | 14 33 | 10·175614 | 9·952405 | 14 59 | 10·047595 | 10·128019 | 14 26 | 9·871981 | 32 | 8 |
| 30 | 30 | 9·824456 | 15 35 | 10·175544 | 9·952532 | 15 64 | 10·047468 | 10·128075 | 15 28 | 9·871925 | 30 | 30 |
| 53 | 32 | 9·824527 | 16 37 | 10·175473 | 9·952659 | 16 68 | 10·047341 | 10·128132 | 16 30 | 9·871868 | 28 | 7 |
| 30 | 34 | 9·824597 | 17 40 | 10·175403 | 9·952786 | 17 72 | 10·047214 | 10·128189 | 17 32 | 9·871811 | 26 | 30 |
| 54 | 36 | 9·824668 | 18 42 | 10·175332 | 9·952913 | 18 76 | 10·047087 | 10·128245 | 18 34 | 9·871755 | 24 | 6 |
| 30 | 38 | 9·824738 | 19 44 | 10·175262 | 9·953040 | 19 80 | 10·046960 | 10·128302 | 19 36 | 9·871698 | 22 | 30 |
| 55 | 40 | 9·824808 | 20 47 | 10·175192 | 9·953167 | 20 85 | 10·046833 | 10·128359 | 20 38 | 9·871641 | 20 | 5 |
| 30 | 42 | 9·824879 | 21 49 | 10·175121 | 9·953294 | 21 89 | 10·046706 | 10·128415 | 21 40 | 9·871585 | 18 | 30 |
| 56 | 44 | 9·824949 | 22 51 | 10·175051 | 9·953421 | 22 93 | 10·046579 | 10·128472 | 22 42 | 9·871528 | 16 | 4 |
| 30 | 46 | 9·825019 | 23 54 | 10·174981 | 9·953548 | 23 97 | 10·046452 | 10·128529 | 23 43 | 9·871471 | 14 | 30 |
| 57 | 48 | 9·825090 | 24 56 | 10·174910 | 9·953675 | 24 102 | 10·046325 | 10·128586 | 24 45 | 9·871414 | 12 | 3 |
| 30 | 50 | 9·825160 | 25 58 | 10·174840 | 9·953802 | 25 106 | 10·046198 | 10·128642 | 25 47 | 9·871358 | 10 | 30 |
| 58 | 52 | 9·825230 | 26 61 | 10·174770 | 9·953929 | 26 110 | 10·046071 | 10·128699 | 26 49 | 9·871301 | 8 | 2 |
| 30 | 54 | 9·825300 | 27 63 | 10·174700 | 9·954056 | 27 114 | 10·045944 | 10·128756 | 27 51 | 9·871244 | 6 | 30 |
| 59 | 56 | 9·825371 | 28 66 | 10·174629 | 9·954183 | 28 118 | 10·045817 | 10·128813 | 28 53 | 9·871187 | 4 | 1 |
| 30 | 58 | 9·825441 | 29 68 | 10·174559 | 9·954310 | 29 123 | 10·045690 | 10·128870 | 29 55 | 9·871130 | 2 | 30 |
| 60 | **48** | 9·825511 | 30 71 | 10·174489 | 9·954437 | 30 127 | 10·045563 | 10·128927 | 30 57 | 9·871073 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

48° — $3^h\ 12^m$

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

| 2h 48m | | | | | | 42° | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
| 0 | 0 | 9·825511 | | 10·174489 | 9·954437 | | 10·045563 | 10·128927 | | 9·871073 | **12** | 60 |
| 30 | 2 | 9·825581 | 1″ 2 | 10·174419 | 9·954564 | 1″ 4 | 10·045436 | 10·128983 | 1″ 2 | 9·871017 | 58 | 30 |
| 1 | 4 | 9·825651 | 2 5 | 10·174349 | 9·954691 | 2 8 | 10·045309 | 10·129040 | 2 4 | 9·870960 | 56 | 59 |
| 30 | 6 | 9·825721 | 3 7 | 10·174279 | 9·954819 | 3 13 | 10·045181 | 10·129097 | 3 6 | 9·870903 | 54 | 30 |
| 2 | 8 | 9·825791 | 4 9 | 10·174209 | 9·954946 | 4 17 | 10·045054 | 10·129154 | 4 8 | 9·870846 | 52 | 58 |
| 30 | 10 | 9·825861 | 5 12 | 10·174139 | 9·955073 | 5 21 | 10·044927 | 10·129211 | 5 10 | 9·870789 | 50 | 30 |
| 3 | 12 | 9·825931 | 6 14 | 10·174069 | 9·955200 | 6 25 | 10·044800 | 10·129268 | 6 11 | 9·870732 | 48 | 57 |
| 30 | 14 | 9·826001 | 7 16 | 10·173999 | 9·955327 | 7 30 | 10·044673 | 10·129325 | 7 13 | 9·870675 | 46 | 30 |
| 4 | 16 | 9·826071 | 8 19 | 10·173929 | 9·955454 | 8 34 | 10·044546 | 10·129382 | 8 15 | 9·870618 | 44 | 56 |
| 30 | 18 | 9·826141 | 9 21 | 10·173859 | 9·955581 | 9 38 | 10·044419 | 10·129439 | 9 17 | 9·870561 | 42 | 30 |
| 5 | 20 | 9·826211 | 10 23 | 10·173789 | 9·955708 | 10 42 | 10·044292 | 10·129496 | 10 19 | 9·870504 | 40 | 55 |
| 30 | 22 | 9·826281 | 11 26 | 10·173719 | 9·955835 | 11 47 | 10·044165 | 10·129553 | 11 21 | 9·870447 | 38 | 30 |
| 6 | 24 | 9·826351 | 12 28 | 10·173649 | 9·955961 | 12 51 | 10·044039 | 10·129610 | 12 23 | 9·870390 | 36 | 54 |
| 30 | 26 | 9·826421 | 13 30 | 10·173579 | 9·956088 | 13 55 | 10·043912 | 10·129667 | 13 25 | 9·870333 | 34 | 30 |
| 7 | 28 | 9·826491 | 14 33 | 10·173509 | 9·956215 | 14 59 | 10·043785 | 10·129724 | 14 27 | 9·870276 | 32 | 53 |
| 30 | 30 | 9·826561 | 15 35 | 10·173439 | 9·956342 | 15 63 | 10·043658 | 10·129782 | 15 29 | 9·870218 | 30 | 30 |
| 8 | 32 | 9·826631 | 16 37 | 10·173369 | 9·956469 | 16 68 | 10·043531 | 10·129839 | 16 30 | 9·870161 | 28 | 52 |
| 30 | 34 | 9·826701 | 17 40 | 10·173299 | 9·956596 | 17 72 | 10·043404 | 10·129896 | 17 32 | 9·870104 | 26 | 30 |
| 9 | 36 | 9·826770 | 18 42 | 10·173230 | 9·956723 | 18 76 | 10·043277 | 10·129953 | 18 34 | 9·870047 | 24 | 51 |
| 30 | 38 | 9·826840 | 19 44 | 10·173160 | 9·956850 | 19 80 | 10·043150 | 10·130010 | 19 36 | 9·869990 | 22 | 30 |
| 10 | 40 | 9·826910 | 20 47 | 10·173090 | 9·956977 | 20 85 | 10·043023 | 10·130067 | 20 38 | 9·869933 | 20 | 50 |
| 30 | 42 | 9·826980 | 21 49 | 10·173020 | 9·957104 | 21 89 | 10·042896 | 10·130125 | 21 40 | 9·869875 | 18 | 30 |
| 11 | 44 | 9·827049 | 22 51 | 10·172951 | 9·957231 | 22 93 | 10·042769 | 10·130182 | 22 42 | 9·869818 | 16 | 49 |
| 30 | 46 | 9·827119 | 23 54 | 10·172881 | 9·957358 | 23 97 | 10·042642 | 10·130239 | 23 44 | 9·869761 | 14 | 30 |
| 12 | 48 | 9·827189 | 24 56 | 10·172811 | 9·957485 | 24 102 | 10·042515 | 10·130296 | 24 46 | 9·869704 | 12 | 48 |
| 30 | 50 | 9·827258 | 25 58 | 10·172742 | 9·957612 | 25 106 | 10·042388 | 10·130354 | 25 48 | 9·869646 | 10 | 30 |
| 13 | 52 | 9·827328 | 26 61 | 10·172672 | 9·957739 | 26 110 | 10·042261 | 10·130411 | 26 49 | 9·869589 | 8 | 47 |
| 30 | 54 | 9·827398 | 27 63 | 10·172602 | 9·957866 | 27 114 | 10·042134 | 10·130468 | 27 51 | 9·869532 | 6 | 30 |
| 14 | 56 | 9·827467 | 28 65 | 10·172533 | 9·957993 | 28 118 | 10·042007 | 10·130526 | 28 53 | 9·869474 | 4 | 46 |
| 30 | 58 | 9·827537 | 29 68 | 10·172463 | 9·958120 | 29 123 | 10·041880 | 10·130583 | 29 55 | 9·869417 | 2 | 30 |
| 15 | **49** | 9·827606 | 30 70 | 10·172394 | 9·958247 | 30 127 | 10·041753 | 10·130640 | 30 57 | 9·869360 | **11** | 45 |
| 30 | 2 | 9·827676 | 1 2 | 10·172324 | 9·958373 | 1 4 | 10·041627 | 10·130698 | 1 2 | 9·869302 | 58 | 30 |
| 16 | 4 | 9·827745 | 2 5 | 10·172255 | 9·958500 | 2 8 | 10·041500 | 10·130755 | 2 4 | 9·869245 | 56 | 44 |
| 30 | 6 | 9·827815 | 3 7 | 10·172185 | 9·958627 | 3 13 | 10·041373 | 10·130812 | 3 6 | 9·869188 | 54 | 30 |
| 17 | 8 | 9·827884 | 4 9 | 10·172116 | 9·958754 | 4 17 | 10·041246 | 10·130870 | 4 8 | 9·869130 | 52 | 43 |
| 30 | 10 | 9·827954 | 5 12 | 10·172046 | 9·958881 | 5 21 | 10·041119 | 10·130927 | 5 10 | 9·869073 | 50 | 30 |
| 18 | 12 | 9·828023 | 6 14 | 10·171977 | 9·959008 | 6 25 | 10·040992 | 10·130985 | 6 12 | 9·869015 | 48 | 42 |
| 30 | 14 | 9·828093 | 7 16 | 10·171907 | 9·959135 | 7 30 | 10·040865 | 10·131042 | 7 13 | 9·868958 | 46 | 30 |
| 19 | 16 | 9·828162 | 8 19 | 10·171838 | 9·959262 | 8 34 | 10·040738 | 10·131100 | 8 15 | 9·868900 | 44 | 41 |
| 30 | 18 | 9·828231 | 9 21 | 10·171769 | 9·959389 | 9 38 | 10·040611 | 10·131157 | 9 17 | 9·868843 | 42 | 30 |
| 20 | 20 | 9·828301 | 10 23 | 10·171699 | 9·959516 | 10 42 | 10·040484 | 10·131215 | 10 19 | 9·868785 | 40 | 40 |
| 30 | 22 | 9·828370 | 11 26 | 10·171630 | 9·959642 | 11 47 | 10·040358 | 10·131272 | 11 21 | 9·868728 | 38 | 30 |
| 21 | 24 | 9·828439 | 12 28 | 10·171561 | 9·959769 | 12 51 | 10·040231 | 10·131330 | 12 23 | 9·868670 | 36 | 39 |
| 30 | 26 | 9·828509 | 13 30 | 10·171491 | 9·959896 | 13 55 | 10·040104 | 10·131388 | 13 25 | 9·868612 | 34 | 30 |
| 22 | 28 | 9·828578 | 14 33 | 10·171422 | 9·960023 | 14 59 | 10·039977 | 10·131445 | 14 27 | 9·868555 | 32 | 38 |
| 30 | 30 | 9·828647 | 15 35 | 10·171353 | 9·960150 | 15 63 | 10·039850 | 10·131503 | 15 29 | 9·868497 | 30 | 30 |
| 23 | 32 | 9·828716 | 16 37 | 10·171284 | 9·960277 | 16 68 | 10·039723 | 10·131560 | 16 31 | 9·868440 | 28 | 37 |
| 30 | 34 | 9·828786 | 17 40 | 10·171214 | 9·960404 | 17 72 | 10·039596 | 10·131618 | 17 33 | 9·868382 | 26 | 30 |
| 24 | 36 | 9·828855 | 18 42 | 10·171145 | 9·960530 | 18 76 | 10·039470 | 10·131676 | 18 35 | 9·868324 | 24 | 36 |
| 30 | 38 | 9·828924 | 19 44 | 10·171076 | 9·960657 | 19 80 | 10·039343 | 10·131733 | 19 36 | 9·868267 | 22 | 30 |
| 25 | 40 | 9·828993 | 20 46 | 10·171007 | 9·960784 | 20 85 | 10·039216 | 10·131791 | 20 38 | 9·868209 | 20 | 35 |
| 30 | 42 | 9·829062 | 21 49 | 10·170938 | 9·960911 | 21 89 | 10·039089 | 10·131849 | 21 40 | 9·868151 | 18 | 30 |
| 26 | 44 | 9·829131 | 22 51 | 10·170869 | 9·961038 | 22 93 | 10·038962 | 10·131907 | 22 42 | 9·868093 | 16 | 34 |
| 30 | 46 | 9·829200 | 23 53 | 10·170800 | 9·961165 | 23 97 | 10·038835 | 10·131964 | 23 44 | 9·868036 | 14 | 30 |
| 27 | 48 | 9·829269 | 24 55 | 10·170731 | 9·961292 | 24 102 | 10·038708 | 10·132022 | 24 46 | 9·867978 | 12 | 33 |
| 30 | 50 | 9·829338 | 25 58 | 10·170662 | 9·961418 | 25 106 | 10·038582 | 10·132080 | 25 48 | 9·867920 | 10 | 30 |
| 28 | 52 | 9·829407 | 26 60 | 10·170593 | 9·961545 | 26 110 | 10·038455 | 10·132138 | 26 50 | 9·867862 | 8 | 32 |
| 30 | 54 | 9·829476 | 27 62 | 10·170524 | 9·961672 | 27 114 | 10·038328 | 10·132196 | 27 52 | 9·867804 | 6 | 30 |
| 29 | 56 | 9·829545 | 28 65 | 10·170455 | 9·961799 | 28 118 | 10·038201 | 10·132253 | 28 54 | 9·867747 | 4 | 31 |
| 30 | 58 | 9·829614 | 29 67 | 10·170386 | 9·961926 | 29 123 | 10·038074 | 10·132311 | 29 56 | 9·867689 | 2 | 30 |
| 30 | **50** | 9·829683 | 30 60 | 10·170317 | 9·962052 | 30 127 | 10·037948 | 10·132369 | 30 58 | 9·867631 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |
| | | | | | | 47° | | | | | 3h 10m | |

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$2^h\ 50^m$ — 42°

| ″′ | m. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. | ″′ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·829683 | | 10·170317 | 9·962052 | | 10·037948 | 10·132369 | | 9·867631 | 10 | 30 |
| 30 | 2 | 9·829752 | 1″ 2 | 10·170248 | 9·962179 | 1″ 4 | 10·037821 | 10·132427 | 1″ 2 | 9·867573 | 58 | 30 |
| 31 | 4 | 9·829821 | 2 5 | 10·170179 | 9·962306 | 2 8 | 10·037694 | 10·132485 | 2 4 | 9·867515 | 56 | 29 |
| 30 | 6 | 9·829890 | 3 7 | 10·170110 | 9·962433 | 3 13 | 10·037567 | 10·132543 | 3 6 | 9·867457 | 54 | 30 |
| 32 | 8 | 9·829959 | 4 9 | 10·170041 | 9·962560 | 4 17 | 10·037440 | 10·132601 | 4 8 | 9·867399 | 52 | 28 |
| 30 | 10 | 9·830028 | 5 12 | 10·169972 | 9·962686 | 5 21 | 10·037314 | 10·132659 | 5 10 | 9·867341 | 50 | 30 |
| 33 | 12 | 9·830097 | 6 14 | 10·169903 | 9·962813 | 6 25 | 10·037187 | 10·132717 | 6 12 | 9·867283 | 48 | 27 |
| 30 | 14 | 9·830165 | 7 16 | 10·169835 | 9·962940 | 7 30 | 10·037060 | 10·132775 | 7 14 | 9·867225 | 46 | 30 |
| 34 | 16 | 9·830234 | 8 19 | 10·169766 | 9·963067 | 8 34 | 10·036933 | 10·132833 | 8 15 | 9·867167 | 44 | 26 |
| 30 | 18 | 9·830303 | 9 21 | 10·169697 | 9·963194 | 9 38 | 10·036806 | 10·132891 | 9 17 | 9·867109 | 42 | 30 |
| 35 | 20 | 9·830372 | 10 23 | 10·169628 | 9·963320 | 10 42 | 10·036680 | 10·132949 | 10 19 | 9·867051 | 40 | 25 |
| 30 | 22 | 9·830440 | 11 25 | 10·169560 | 9·963447 | 11 46 | 10·036553 | 10·133007 | 11 21 | 9·866993 | 38 | 30 |
| 36 | 24 | 9·830509 | 12 27 | 10·169491 | 9·963574 | 12 51 | 10·036426 | 10·133065 | 12 23 | 9·866935 | 36 | 24 |
| 30 | 26 | 9·830578 | 13 30 | 10·169422 | 9·963701 | 13 55 | 10·036299 | 10·133123 | 13 25 | 9·866877 | 34 | 30 |
| 37 | 28 | 9·830646 | 14 32 | 10·169354 | 9·963828 | 14 59 | 10·036172 | 10·133181 | 14 27 | 9·866819 | 32 | 23 |
| 30 | 30 | 9·830715 | 15 34 | 10·169285 | 9·963954 | 15 63 | 10·036046 | 10·133239 | 15 29 | 9·866761 | 30 | 30 |
| 38 | 32 | 9·830784 | 16 36 | 10·169216 | 9·964081 | 16 68 | 10·035919 | 10·133297 | 16 31 | 9·866703 | 28 | 22 |
| 30 | 34 | 9·830852 | 17 39 | 10·169148 | 9·964208 | 17 72 | 10·035792 | 10·133356 | 17 33 | 9·866644 | 26 | 30 |
| 39 | 36 | 9·830921 | 18 41 | 10·169079 | 9·964335 | 18 76 | 10·035665 | 10·133414 | 18 35 | 9·866586 | 24 | 21 |
| 30 | 38 | 9·830989 | 19 43 | 10·169011 | 9·964461 | 19 80 | 10·035539 | 10·133472 | 19 37 | 9·866528 | 22 | 30 |
| 40 | 40 | 9·831058 | 20 46 | 10·168942 | 9·964588 | 20 84 | 10·035412 | 10·133530 | 20 39 | 9·866470 | 20 | 20 |
| 30 | 42 | 9·831127 | 21 48 | 10·168873 | 9·964715 | 21 89 | 10·035285 | 10·133588 | 21 41 | 9·866412 | 18 | 30 |
| 41 | 44 | 9·831195 | 22 50 | 10·168805 | 9·964842 | 22 93 | 10·035158 | 10·133647 | 22 43 | 9·866353 | 16 | 19 |
| 30 | 46 | 9·831263 | 23 52 | 10·168736 | 9·964968 | 23 97 | 10·035032 | 10·133705 | 23 44 | 9·866295 | 14 | 30 |
| 42 | 48 | 9·831332 | 24 55 | 10·168668 | 9·965095 | 24 101 | 10·034905 | 10·133763 | 24 46 | 9·866237 | 12 | 18 |
| 30 | 50 | 9·831400 | 25 57 | 10·168600 | 9·965222 | 25 105 | 10·034778 | 10·133821 | 25 48 | 9·866179 | 10 | 30 |
| 43 | 52 | 9·831469 | 26 59 | 10·168531 | 9·965349 | 26 110 | 10·034651 | 10·133880 | 26 50 | 9·866120 | 8 | 17 |
| 30 | 54 | 9·831537 | 27 62 | 10·168463 | 9·965475 | 27 114 | 10·034525 | 10·133938 | 27 52 | 9·866062 | 6 | 30 |
| 44 | 56 | 9·831606 | 28 64 | 10·168394 | 9·965602 | 28 118 | 10·034398 | 10·133996 | 28 54 | 9·866004 | 4 | 16 |
| 30 | 58 | 9·831674 | 29 66 | 10·168326 | 9·965729 | 29 122 | 10·034271 | 10·134055 | 29 56 | 9·865945 | 2 | 30 |
| 45 | 51 | 9·831742 | 30 69 | 10·168258 | 9·965855 | 30 127 | 10·034145 | 10·134113 | 30 58 | 9·865887 | 9 | 15 |
| 30 | 2 | 9·831811 | 1 2 | 10·168189 | 9·965982 | 1 4 | 10·034018 | 10·134172 | 1 2 | 9·865828 | 58 | 30 |
| 46 | 4 | 9·831879 | 2 5 | 10·168121 | 9·966109 | 2 8 | 10·033891 | 10·134230 | 2 4 | 9·865770 | 56 | 14 |
| 30 | 6 | 9·831947 | 3 7 | 10·168053 | 9·966236 | 3 13 | 10·033764 | 10·134288 | 3 6 | 9·865712 | 54 | 30 |
| 47 | 8 | 9·832015 | 4 9 | 10·167985 | 9·966362 | 4 17 | 10·033638 | 10·134347 | 4 8 | 9·865653 | 52 | 13 |
| 30 | 10 | 9·832084 | 5 12 | 10·167916 | 9·966489 | 5 21 | 10·033511 | 10·134405 | 5 10 | 9·865595 | 50 | 30 |
| 48 | 12 | 9·832152 | 6 14 | 10·167848 | 9·966616 | 6 25 | 10·033384 | 10·134464 | 6 12 | 9·865536 | 48 | 12 |
| 30 | 14 | 9·832220 | 7 16 | 10·167780 | 9·966742 | 7 30 | 10·033258 | 10·134522 | 7 14 | 9·865478 | 46 | 30 |
| 49 | 16 | 9·832288 | 8 19 | 10·167712 | 9·966869 | 8 34 | 10·033131 | 10·134581 | 8 16 | 9·865419 | 44 | 11 |
| 30 | 18 | 9·832356 | 9 21 | 10·167643 | 9·966996 | 9 38 | 10·033004 | 10·134639 | 9 18 | 9·865361 | 42 | 30 |
| 50 | 20 | 9·832425 | 10 23 | 10·167575 | 9·967123 | 10 42 | 10·032877 | 10·134698 | 10 20 | 9·865302 | 40 | 10 |
| 30 | 22 | 9·832493 | 11 25 | 10·167507 | 9·967249 | 11 46 | 10·032751 | 10·134756 | 11 21 | 9·865244 | 38 | 30 |
| 51 | 24 | 9·832561 | 12 27 | 10·167439 | 9·967376 | 12 51 | 10·032624 | 10·134815 | 12 23 | 9·865185 | 36 | 9 |
| 30 | 26 | 9·832629 | 13 30 | 10·167371 | 9·967503 | 13 55 | 10·032497 | 10·134874 | 13 25 | 9·865126 | 34 | 30 |
| 52 | 28 | 9·832697 | 14 32 | 10·167303 | 9·967629 | 14 59 | 10·032371 | 10·134932 | 14 27 | 9·865068 | 32 | 8 |
| 30 | 30 | 9·832765 | 15 34 | 10·167235 | 9·967756 | 15 63 | 10·032244 | 10·134991 | 15 29 | 9·865009 | 30 | 30 |
| 53 | 32 | 9·832833 | 16 36 | 10·167167 | 9·967883 | 16 68 | 10·032117 | 10·135050 | 16 31 | 9·864950 | 28 | 7 |
| 30 | 34 | 9·832901 | 17 39 | 10·167099 | 9·968009 | 17 72 | 10·031991 | 10·135108 | 17 33 | 9·864892 | 26 | 30 |
| 54 | 36 | 9·832969 | 18 41 | 10·167031 | 9·968136 | 18 76 | 10·031864 | 10·135167 | 18 35 | 9·864833 | 24 | 6 |
| 30 | 38 | 9·833037 | 19 43 | 10·166963 | 9·968263 | 19 80 | 10·031737 | 10·135226 | 19 37 | 9·864774 | 22 | 30 |
| 55 | 40 | 9·833105 | 20 45 | 10·166895 | 9·968389 | 20 84 | 10·031611 | 10·135284 | 20 39 | 9·864716 | 20 | 5 |
| 30 | 42 | 9·833173 | 21 48 | 10·166827 | 9·968516 | 21 89 | 10·031484 | 10·135343 | 21 41 | 9·864657 | 18 | 30 |
| 56 | 44 | 9·833241 | 22 50 | 10·166759 | 9·968643 | 22 93 | 10·031357 | 10·135402 | 22 43 | 9·864598 | 16 | 4 |
| 30 | 46 | 9·833309 | 23 52 | 10·166691 | 9·968769 | 23 97 | 10·031231 | 10·135461 | 23 45 | 9·864539 | 14 | 30 |
| 57 | 48 | 9·833377 | 24 55 | 10·166623 | 9·968896 | 24 101 | 10·031104 | 10·135519 | 24 47 | 9·864481 | 12 | 3 |
| 30 | 50 | 9·833444 | 25 57 | 10·166556 | 9·969023 | 25 106 | 10·030977 | 10·135578 | 25 49 | 9·864422 | 10 | 30 |
| 58 | 52 | 9·833512 | 26 59 | 10·166488 | 9·969149 | 26 110 | 10·030851 | 10·135637 | 26 51 | 9·864363 | 8 | 2 |
| 30 | 54 | 9·833580 | 27 61 | 10·166420 | 9·969276 | 27 114 | 10·030724 | 10·135696 | 27 53 | 9·864304 | 6 | 30 |
| 59 | 56 | 9·833648 | 28 64 | 10·166352 | 9·969403 | 28 118 | 10·030597 | 10·135755 | 28 55 | 9·864245 | 4 | 1 |
| 30 | 58 | 9·833716 | 29 66 | 10·166284 | 9·969529 | 29 122 | 10·030471 | 10·135814 | 29 57 | 9·864186 | 2 | 30 |
| 60 | 52 | 9·833783 | 30 68 | 10·166217 | 9·969656 | 30 127 | 10·030344 | 10·135873 | 30 59 | 9·864127 | 0 | 0 |
| ″′ | m. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ″′ |

47° — $3^h\ 8^m$

## TABLE XXVI.—(*continued*).

### LOG. SINES, COSINES, &c.

$2^h\ 52^m$ — 43°

| ′ ″ | m. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·833783 | | 10·166217 | 9·969656 | | 10·030344 | 10·135873 | | 9·864127 | 8 | 60 |
| 30 | 2 | 9·833851 | 1″ 2 | 10·166149 | 9·969783 | 1″ 4 | 10·030217 | 10·135931 | 1″ 2 | 9·864069 | 58 | 30 |
| 1 | 4 | 9·833919 | 2 4 | 10·166081 | 9·969909 | 2 8 | 10·030091 | 10·135990 | 2 4 | 9·864010 | 56 | 59 |
| 30 | 6 | 9·833986 | 3 7 | 10·166014 | 9·970036 | 3 13 | 10·029964 | 10·136049 | 3 6 | 9·863951 | 54 | 30 |
| 2 | 8 | 9·834054 | 4 9 | 10·165946 | 9·970162 | 4 17 | 10·029838 | 10·136108 | 4 8 | 9·863892 | 52 | 58 |
| 30 | 10 | 9·834122 | 5 11 | 10·165878 | 9·970289 | 5 21 | 10·029711 | 10·136167 | 5 10 | 9·863833 | 50 | 30 |
| 3 | 12 | 9·834189 | 6 13 | 10·165811 | 9·970416 | 6 25 | 10·029584 | 10·136226 | 6 12 | 9·863774 | 48 | 57 |
| 30 | 14 | 9·834257 | 7 16 | 10·165743 | 9·970542 | 7 30 | 10·029458 | 10·136285 | 7 14 | 9·863715 | 46 | 30 |
| 4 | 16 | 9·834325 | 8 18 | 10·165675 | 9·970669 | 8 34 | 10·029331 | 10·136344 | 8 16 | 9·863656 | 44 | 56 |
| 30 | 18 | 9·834392 | 9 20 | 10·165608 | 9·970796 | 9 38 | 10·029204 | 10·136403 | 9 18 | 9·863597 | 42 | 30 |
| 5 | 20 | 9·834460 | 10 22 | 10·165540 | 9·970922 | 10 42 | 10·029078 | 10·136462 | 10 20 | 9·863538 | 40 | 55 |
| 30 | 22 | 9·834527 | 11 25 | 10·165473 | 9·971049 | 11 46 | 10·028951 | 10·136522 | 11 22 | 9·863478 | 38 | 30 |
| 6 | 24 | 9·834595 | 12 27 | 10·165405 | 9·971175 | 12 51 | 10·028825 | 10·136581 | 12 24 | 9·863419 | 36 | 54 |
| 30 | 26 | 9·834662 | 13 29 | 10·165338 | 9·971302 | 13 55 | 10·028698 | 10·136640 | 13 26 | 9·863360 | 34 | 30 |
| 7 | 28 | 9·834730 | 14 31 | 10·165270 | 9·971429 | 14 59 | 10·028571 | 10·136699 | 14 28 | 9·863301 | 32 | 53 |
| 30 | 30 | 9·834797 | 15 34 | 10·165203 | 9·971555 | 15 63 | 10·028445 | 10·136758 | 15 30 | 9·863242 | 30 | 30 |
| 8 | 32 | 9·834865 | 16 36 | 10·165135 | 9·971682 | 16 68 | 10·028318 | 10·136817 | 16 32 | 9·863183 | 28 | 52 |
| 30 | 34 | 9·834932 | 17 38 | 10·165068 | 9·971808 | 17 72 | 10·028192 | 10·136876 | 17 33 | 9·863124 | 26 | 30 |
| 9 | 36 | 9·834999 | 18 41 | 10·165001 | 9·971935 | 18 76 | 10·028065 | 10·136936 | 18 35 | 9·863064 | 24 | 51 |
| 30 | 38 | 9·835067 | 19 43 | 10·164933 | 9·972062 | 19 80 | 10·027938 | 10·136995 | 19 37 | 9·863005 | 22 | 30 |
| 10 | 40 | 9·835134 | 20 45 | 10·164866 | 9·972188 | 20 84 | 10·027812 | 10·137054 | 20 39 | 9·862946 | 20 | 50 |
| 30 | 42 | 9·835201 | 21 47 | 10·164799 | 9·972315 | 21 89 | 10·027685 | 10·137113 | 21 41 | 9·862887 | 18 | 30 |
| 11 | 44 | 9·835269 | 22 49 | 10·164731 | 9·972441 | 22 93 | 10·027559 | 10·137173 | 22 43 | 9·862827 | 16 | 49 |
| 30 | 46 | 9·835336 | 23 52 | 10·164664 | 9·972568 | 23 97 | 10·027432 | 10·137232 | 23 45 | 9·862768 | 14 | 30 |
| 12 | 48 | 9·835403 | 24 54 | 10·164597 | 9·972695 | 24 101 | 10·027305 | 10·137291 | 24 47 | 9·862709 | 12 | 48 |
| 30 | 50 | 9·835471 | 25 56 | 10·164529 | 9·972821 | 25 105 | 10·027179 | 10·137350 | 25 49 | 9·862650 | 10 | 30 |
| 13 | 52 | 9·835538 | 26 58 | 10·164462 | 9·972948 | 26 110 | 10·027052 | 10·137410 | 26 51 | 9·862590 | 8 | 47 |
| 30 | 54 | 9·835605 | 27 61 | 10·164395 | 9·973074 | 27 114 | 10·026926 | 10·137469 | 27 53 | 9·862531 | 6 | 30 |
| 14 | 56 | 9·835672 | 28 63 | 10·164328 | 9·973201 | 28 118 | 10·026799 | 10·137529 | 28 55 | 9·862471 | 4 | 46 |
| 30 | 58 | 9·835739 | 29 65 | 10·164261 | 9·973327 | 29 122 | 10·026673 | 10·137588 | 29 57 | 9·862412 | 2 | 30 |
| 15 | **53** | 9·835807 | 30 68 | 10·164193 | 9·973454 | 30 126 | 10·026546 | 10·137647 | 30 59 | 9·862353 | **7** | 45 |
| 30 | 2 | 9·835874 | 1 2 | 10·164126 | 9·973581 | 1 4 | 10·026419 | 10·137707 | 1 2 | 9·862293 | 58 | 30 |
| 16 | 4 | 9·835941 | 2 4 | 10·164059 | 9·973707 | 2 8 | 10·026293 | 10·137766 | 2 4 | 9·862234 | 56 | 44 |
| 30 | 6 | 9·836008 | 3 7 | 10·163992 | 9·973834 | 3 13 | 10·026166 | 10·137826 | 3 6 | 9·862174 | 54 | 30 |
| 17 | 8 | 9·836075 | 4 9 | 10·163925 | 9·973960 | 4 17 | 10·026040 | 10·137885 | 4 8 | 9·862115 | 52 | 43 |
| 30 | 10 | 9·836142 | 5 11 | 10·163858 | 9·974087 | 5 21 | 10·025913 | 10·137945 | 5 10 | 9·862055 | 50 | 30 |
| 18 | 12 | 9·836209 | 6 13 | 10·163791 | 9·974213 | 6 25 | 10·025787 | 10·138004 | 6 12 | 9·861996 | 48 | 42 |
| 30 | 14 | 9·836276 | 7 16 | 10·163724 | 9·974340 | 7 30 | 10·025660 | 10·138064 | 7 14 | 9·861936 | 46 | 30 |
| 19 | 16 | 9·836343 | 8 18 | 10·163657 | 9·974466 | 8 34 | 10·025534 | 10·138123 | 8 16 | 9·861877 | 44 | 41 |
| 30 | 18 | 9·836410 | 9 20 | 10·163590 | 9·974593 | 9 38 | 10·025407 | 10·138183 | 9 18 | 9·861817 | 42 | 30 |
| 20 | 20 | 9·836477 | 10 22 | 10·163523 | 9·974720 | 10 42 | 10·025280 | 10·138242 | 10 20 | 9·861758 | 40 | 40 |
| 30 | 22 | 9·836544 | 11 25 | 10·163456 | 9·974846 | 11 46 | 10·025154 | 10·138302 | 11 22 | 9·861698 | 38 | 30 |
| 21 | 24 | 9·836611 | 12 27 | 10·163389 | 9·974973 | 12 51 | 10·025027 | 10·138362 | 12 24 | 9·861638 | 36 | 39 |
| 30 | 26 | 9·836678 | 13 29 | 10·163322 | 9·975099 | 13 55 | 10·024901 | 10·138421 | 13 26 | 9·861579 | 34 | 30 |
| 22 | 28 | 9·836745 | 14 31 | 10·163255 | 9·975226 | 14 59 | 10·024774 | 10·138481 | 14 28 | 9·861519 | 32 | 38 |
| 30 | 30 | 9·836812 | 15 33 | 10·163188 | 9·975352 | 15 63 | 10·024648 | 10·138541 | 15 30 | 9·861459 | 30 | 30 |
| 23 | 32 | 9·836878 | 16 36 | 10·163122 | 9·975479 | 16 68 | 10·024521 | 10·138600 | 16 32 | 9·861400 | 28 | 37 |
| 30 | 34 | 9·836945 | 17 38 | 10·163055 | 9·975605 | 17 72 | 10·024395 | 10·138660 | 17 34 | 9·861340 | 26 | 30 |
| 24 | 36 | 9·837012 | 18 40 | 10·162988 | 9·975732 | 18 76 | 10·024268 | 10·138720 | 18 36 | 9·861280 | 24 | 36 |
| 30 | 38 | 9·837079 | 19 42 | 10·162921 | 9·975858 | 19 80 | 10·024142 | 10·138779 | 19 38 | 9·861221 | 22 | 30 |
| 25 | 40 | 9·837146 | 20 45 | 10·162854 | 9·975985 | 20 84 | 10·024015 | 10·138839 | 20 40 | 9·861161 | 20 | 35 |
| 30 | 42 | 9·837212 | 21 47 | 10·162788 | 9·976111 | 21 89 | 10·023889 | 10·138899 | 21 42 | 9·861101 | 18 | 30 |
| 26 | 44 | 9·837279 | 22 49 | 10·162721 | 9·976238 | 22 93 | 10·023762 | 10·138959 | 22 44 | 9·861041 | 16 | 34 |
| 30 | 46 | 9·837346 | 23 52 | 10·162654 | 9·976364 | 23 97 | 10·023636 | 10·139019 | 23 46 | 9·860981 | 14 | 30 |
| 27 | 48 | 9·837412 | 24 54 | 10·162588 | 9·976491 | 24 101 | 10·023509 | 10·139078 | 24 48 | 9·860922 | 12 | 33 |
| 30 | 50 | 9·837479 | 25 56 | 10·162521 | 9·976617 | 25 105 | 10·023383 | 10·139138 | 25 50 | 9·860862 | 10 | 30 |
| 28 | 52 | 9·837546 | 26 58 | 10·162454 | 9·976744 | 26 110 | 10·023256 | 10·139198 | 26 52 | 9·860802 | 8 | 32 |
| 30 | 54 | 9·837612 | 27 60 | 10·162388 | 9·976870 | 27 114 | 10·023130 | 10·139258 | 27 54 | 9·860742 | 6 | 30 |
| 29 | 56 | 9·837679 | 28 63 | 10·162321 | 9·976997 | 28 118 | 10·023003 | 10·139318 | 28 56 | 9·860682 | 4 | 31 |
| 30 | 58 | 9·837746 | 29 65 | 10·162254 | 9·977123 | 29 122 | 10·022877 | 10·139378 | 29 58 | 9·860622 | 2 | 30 |
| 30 | **54** | 9·837812 | 30 67 | 10·162188 | 9·977250 | 30 126 | 10·022750 | 10·139438 | 30 60 | 9·860562 | 0 | 30 |
| ′ ″ | m. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. | ′ ″ |

46° — $3^h\ 6^m$

TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

$2^h$ $54^m$ 43°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·837812 | | 10·162188 | 9·977250 | | 10·022750 | 10·139438 | | 9·860562 | 6 | 30 |
| 30 | 2 | 9·837879 | 1″ 2 | 10·162121 | 9·977377 | 1″ 4 | 10·022623 | 10·139498 | 1″ 2 | 9·860502 | 58 | 30 |
| 31 | 4 | 9·837945 | 2 4 | 10·162055 | 9·977503 | 2 8 | 10·022497 | 10·139558 | 2 4 | 9·860442 | 56 | 29 |
| 30 | 6 | 9·838012 | 3 7 | 10·161988 | 9·977630 | 3 13 | 10·022370 | 10·139618 | 3 6 | 9·860382 | 54 | 30 |
| 32 | 8 | 9·838078 | 4 9 | 10·161922 | 9·977756 | 4 17 | 10·022244 | 10·139678 | 4 8 | 9·860322 | 52 | 28 |
| 30 | 10 | 9·838145 | 5 11 | 10·161855 | 9·977882 | 5 21 | 10·022118 | 10·139738 | 5 10 | 9·860262 | 50 | 30 |
| 33 | 12 | 9·838211 | 6 13 | 10·161789 | 9·978009 | 6 25 | 10·021991 | 10·139798 | 6 12 | 9·860202 | 48 | 27 |
| 30 | 14 | 9·838278 | 7 15 | 10·161722 | 9·978135 | 7 30 | 10·021865 | 10·139858 | 7 14 | 9·860142 | 46 | 30 |
| 34 | 16 | 9·838344 | 8 17 | 10·161656 | 9·978262 | 8 34 | 10·021738 | 10·139918 | 8 16 | 9·860082 | 44 | 26 |
| 30 | 18 | 9·838410 | 9 20 | 10·161590 | 9·978388 | 9 38 | 10·021612 | 10·139978 | 9 18 | 9·860022 | 42 | 30 |
| 35 | 20 | 9·838477 | 10 22 | 10·161523 | 9·978515 | 10 42 | 10·021485 | 10·140038 | 10 20 | 9·859962 | 40 | 25 |
| 30 | 22 | 9·838543 | 11 24 | 10·161457 | 9·978641 | 11 46 | 10·021359 | 10·140098 | 11 22 | 9·859902 | 38 | 30 |
| 36 | 24 | 9·838610 | 12 27 | 10·161390 | 9·978768 | 12 51 | 10·021232 | 10·140158 | 12 24 | 9·859842 | 36 | 24 |
| 30 | 26 | 9·838676 | 13 29 | 10·161324 | 9·978894 | 13 55 | 10·021106 | 10·140219 | 13 26 | 9·859781 | 34 | 30 |
| 37 | 28 | 9·838742 | 14 31 | 10·161258 | 9·979021 | 14 59 | 10·020979 | 10·140279 | 14 28 | 9·859721 | 32 | 23 |
| 30 | 30 | 9·838808 | 15 33 | 10·161192 | 9·979147 | 15 63 | 10·020853 | 10·140339 | 15 30 | 9·859661 | 30 | 30 |
| 38 | 32 | 9·838875 | 16 35 | 10·161125 | 9·979274 | 16 67 | 10·020726 | 10·140399 | 16 32 | 9·859601 | 28 | 22 |
| 30 | 34 | 9·838941 | 17 37 | 10·161059 | 9·979400 | 17 72 | 10·020600 | 10·140459 | 17 34 | 9·859541 | 26 | 30 |
| 39 | 36 | 9·839007 | 18 40 | 10·160993 | 9·979527 | 18 76 | 10·020473 | 10·140520 | 18 36 | 9·859480 | 24 | 21 |
| 30 | 38 | 9·839073 | 19 42 | 10·160927 | 9·979653 | 19 80 | 10·020347 | 10·140580 | 19 38 | 9·859420 | 22 | 30 |
| 40 | 40 | 9·839140 | 20 44 | 10·160860 | 9·979780 | 20 84 | 10·020220 | 10·140640 | 20 40 | 9·859360 | 20 | 20 |
| 30 | 42 | 9·839206 | 21 46 | 10·160794 | 9·979906 | 21 89 | 10·020094 | 10·140700 | 21 42 | 9·859300 | 18 | 30 |
| 41 | 44 | 9·839272 | 22 48 | 10·160728 | 9·980033 | 22 93 | 10·019967 | 10·140761 | 22 44 | 9·859239 | 16 | 19 |
| 30 | 46 | 9·839338 | 23 51 | 10·160662 | 9·980159 | 23 97 | 10·019841 | 10·140821 | 23 46 | 9·859179 | 14 | 30 |
| 42 | 48 | 9·839404 | 24 53 | 10·160596 | 9·980286 | 24 101 | 10·019714 | 10·140881 | 24 48 | 9·859119 | 12 | 18 |
| 30 | 50 | 9·839470 | 25 55 | 10·160530 | 9·980412 | 25 105 | 10·019588 | 10·140942 | 25 50 | 9·859058 | 10 | 30 |
| 43 | 52 | 9·839536 | 26 57 | 10·160464 | 9·980538 | 26 110 | 10·019462 | 10·141002 | 26 52 | 9·858998 | 8 | 17 |
| 30 | 54 | 9·839602 | 27 60 | 10·160398 | 9·980665 | 27 114 | 10·019335 | 10·141063 | 27 54 | 9·858937 | 6 | 30 |
| 44 | 56 | 9·839668 | 28 62 | 10·160332 | 9·980791 | 28 118 | 10·019209 | 10·141123 | 28 56 | 9·858877 | 4 | 16 |
| 30 | 58 | 9·839734 | 29 64 | 10·160266 | 9·980918 | 29 122 | 10·019082 | 10·141183 | 29 58 | 9·858817 | 2 | 30 |
| 45 | **55** | 9·839800 | 30 66 | 10·160200 | 9·981044 | 30 126 | 10·018956 | 10·141244 | 30 60 | 9·858756 | **5** | 15 |
| 30 | 2 | 9·839866 | 1 2 | 10·160134 | 9·981171 | 1 4 | 10·018829 | 10·141304 | 1 2 | 9·858696 | 58 | 30 |
| 46 | 4 | 9·839932 | 2 4 | 10·160068 | 9·981297 | 2 8 | 10·018703 | 10·141365 | 2 4 | 9·858635 | 56 | 14 |
| 30 | 6 | 9·839998 | 3 7 | 10·160002 | 9·981424 | 3 13 | 10·018576 | 10·141425 | 3 6 | 9·858575 | 54 | 30 |
| 47 | 8 | 9·840064 | 4 9 | 10·159936 | 9·981550 | 4 17 | 10·018450 | 10·141486 | 4 8 | 9·858514 | 52 | 13 |
| 30 | 10 | 9·840130 | 5 11 | 10·159870 | 9·981677 | 5 21 | 10·018323 | 10·141546 | 5 10 | 9·858454 | 50 | 30 |
| 48 | 12 | 9·840196 | 6 13 | 10·159804 | 9·981803 | 6 25 | 10·018197 | 10·141607 | 6 12 | 9·858393 | 48 | 12 |
| 30 | 14 | 9·840262 | 7 15 | 10·159738 | 9·981929 | 7 29 | 10·018071 | 10·141668 | 7 14 | 9·858332 | 46 | 30 |
| 49 | 16 | 9·840328 | 8 17 | 10·159672 | 9·982056 | 8 34 | 10·017944 | 10·141728 | 8 16 | 9·858272 | 44 | 11 |
| 30 | 18 | 9·840393 | 9 20 | 10·159607 | 9·982182 | 9 38 | 10·017818 | 10·141789 | 9 18 | 9·858211 | 42 | 30 |
| 50 | 20 | 9·840459 | 10 22 | 10·159541 | 9·982309 | 10 42 | 10·017691 | 10·141849 | 10 20 | 9·858151 | 40 | 10 |
| 30 | 22 | 9·840525 | 11 24 | 10·159475 | 9·982435 | 11 46 | 10·017565 | 10·141910 | 11 22 | 9·858090 | 38 | 30 |
| 51 | 24 | 9·840591 | 12 26 | 10·159409 | 9·982562 | 12 51 | 10·017438 | 10·141971 | 12 24 | 9·858029 | 36 | 9 |
| 30 | 26 | 9·840657 | 13 29 | 10·159343 | 9·982688 | 13 55 | 10·017312 | 10·142032 | 13 26 | 9·857968 | 34 | 30 |
| 52 | 28 | 9·840722 | 14 31 | 10·159278 | 9·982814 | 14 59 | 10·017186 | 10·142092 | 14 28 | 9·857908 | 32 | 8 |
| 30 | 30 | 9·840788 | 15 33 | 10·159212 | 9·982941 | 15 63 | 10·017059 | 10·142153 | 15 30 | 9·857847 | 30 | 30 |
| 53 | 32 | 9·840854 | 16 35 | 10·159146 | 9·983067 | 16 67 | 10·016933 | 10·142214 | 16 32 | 9·857786 | 28 | 7 |
| 30 | 34 | 9·840919 | 17 37 | 10·159081 | 9·983194 | 17 72 | 10·016806 | 10·142274 | 17 34 | 9·857726 | 26 | 30 |
| 54 | 36 | 9·840985 | 18 39 | 10·159015 | 9·983320 | 18 76 | 10·016680 | 10·142335 | 18 36 | 9·857665 | 24 | 6 |
| 30 | 38 | 9·841051 | 19 42 | 10·158949 | 9·983447 | 19 80 | 10·016553 | 10·142396 | 19 38 | 9·857604 | 22 | 30 |
| 55 | 40 | 9·841116 | 20 44 | 10·158884 | 9·983573 | 20 84 | 10·016427 | 10·142457 | 20 40 | 9·857543 | 20 | 5 |
| 30 | 42 | 9·841182 | 21 46 | 10·158818 | 9·983699 | 21 88 | 10·016301 | 10·142518 | 21 42 | 9·857482 | 18 | 30 |
| 56 | 44 | 9·841247 | 22 48 | 10·158753 | 9·983826 | 22 93 | 10·016174 | 10·142578 | 22 45 | 9·857422 | 16 | 4 |
| 30 | 46 | 9·841313 | 23 51 | 10·158687 | 9·983952 | 23 97 | 10·016048 | 10·142639 | 23 46 | 9·857361 | 14 | 30 |
| 57 | 48 | 9·841378 | 24 53 | 10·158622 | 9·984079 | 24 101 | 10·015921 | 10·142700 | 24 48 | 9·857300 | 12 | 3 |
| 30 | 50 | 9·841444 | 25 55 | 10·158556 | 9·984205 | 25 105 | 10·015795 | 10·142761 | 25 51 | 9·857239 | 10 | 30 |
| 58 | 52 | 9·841509 | 26 57 | 10·158491 | 9·984331 | 26 109 | 10·015668 | 10·142822 | 26 53 | 9·857178 | 8 | 2 |
| 30 | 54 | 9·841575 | 27 59 | 10·158425 | 9·984458 | 27 114 | 10·015542 | 10·142883 | 27 55 | 9·857117 | 6 | 30 |
| 59 | 56 | 9·841640 | 28 61 | 10·158360 | 9·984584 | 28 118 | 10·015416 | 10·142944 | 28 57 | 9·857056 | 4 | 1 |
| 30 | 58 | 9·841706 | 29 64 | 10·158294 | 9·984711 | 29 122 | 10·015289 | 10·143005 | 29 59 | 9·856995 | 2 | 30 |
| 60 | **56** | 9·841771 | 30 66 | 10·158229 | 9·984837 | 30 126 | 10·015163 | 10·143066 | 30 61 | 9·856934 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

46° $3^h$ $4^m$

## TABLE XXVI.—(*continued*).

LOG. SINES, COSINES, &c.

$2^h$ $56^m$ 44°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 9·841771 | | 10·158229 | 9·984837 | | 10·015163 | 10·143066 | | 9·856934 | 4 | 60 |
| 30 | 2 | 9·841837 | 1″ 2 | 10·158163 | 9·984964 | 1″ 4 | 10·015036 | 10·143127 | 1″ 2 | 9·856873 | 58 | 30 |
| 1 | 4 | 9·841902 | 2 4 | 10·158098 | 9·985090 | 2 8 | 10·014910 | 10·143188 | 2 4 | 9·856812 | 56 | 59 |
| 30 | 6 | 9·841967 | 3 7 | 10·158033 | 9·985216 | 3 13 | 10·014784 | 10·143249 | 3 6 | 9·856751 | 54 | 30 |
| 2 | 8 | 9·842033 | 4 9 | 10·157967 | 9·985343 | 4 17 | 10·014657 | 10·143310 | 4 8 | 9·856690 | 52 | 58 |
| 30 | 10 | 9·842098 | 5 11 | 10·157902 | 9·985469 | 5 21 | 10·014531 | 10·143371 | 5 10 | 9·856629 | 50 | 30 |
| 3 | 12 | 9·842163 | 6 13 | 10·157837 | 9·985596 | 6 25 | 10·014404 | 10·143432 | 6 12 | 9·856568 | 48 | 57 |
| 30 | 14 | 9·842229 | 7 15 | 10·157771 | 9·985722 | 7 29 | 10·014278 | 10·143493 | 7 14 | 9·856507 | 46 | 30 |
| 4 | 16 | 9·842294 | 8 17 | 10·157706 | 9·985848 | 8 34 | 10·014152 | 10·143554 | 8 16 | 9·856446 | 44 | 56 |
| 30 | 18 | 9·842359 | 9 20 | 10·157641 | 9·985975 | 9 38 | 10·014025 | 10·143616 | 9 18 | 9·856384 | 42 | 30 |
| 5 | 20 | 9·842424 | 10 22 | 10·157576 | 9·986101 | 10 42 | 10·013899 | 10·143677 | 10 20 | 9·856323 | 40 | 55 |
| 30 | 22 | 9·842490 | 11 24 | 10·157510 | 9·986228 | 11 46 | 10·013772 | 10·143738 | 11 22 | 9·856262 | 38 | 30 |
| 6 | 24 | 9·842555 | 12 26 | 10·157445 | 9·986354 | 12 51 | 10·013646 | 10·143799 | 12 24 | 9·856201 | 36 | 54 |
| 30 | 26 | 9·842620 | 13 28 | 10·157380 | 9·986480 | 13 55 | 10·013520 | 10·143860 | 13 27 | 9·856140 | 34 | 30 |
| 7 | 28 | 9·842685 | 14 30 | 10·157315 | 9·986607 | 14 59 | 10·013393 | 10·143922 | 14 29 | 9·856078 | 32 | 53 |
| 30 | 30 | 9·842750 | 15 33 | 10·157250 | 9·986733 | 15 63 | 10·013267 | 10·143983 | 15 31 | 9·856017 | 30 | 30 |
| 8 | 32 | 9·842815 | 16 35 | 10·157185 | 9·986860 | 16 67 | 10·013140 | 10·144044 | 16 33 | 9·855956 | 28 | 52 |
| 30 | 34 | 9·842880 | 17 37 | 10·157120 | 9·986986 | 17 72 | 10·013014 | 10·144106 | 17 35 | 9·855895 | 26 | 30 |
| 9 | 36 | 9·842946 | 18 39 | 10·157054 | 9·987112 | 18 76 | 10·012888 | 10·144167 | 18 37 | 9·855833 | 24 | 51 |
| 30 | 38 | 9·843011 | 19 41 | 10·156989 | 9·987239 | 19 80 | 10·012761 | 10·144228 | 19 39 | 9·855772 | 22 | 30 |
| 10 | 40 | 9·843076 | 20 43 | 10·156924 | 9·987365 | 20 84 | 10·012635 | 10·144289 | 20 41 | 9·855711 | 20 | 50 |
| 30 | 42 | 9·843141 | 21 46 | 10·156859 | 9·987491 | 21 88 | 10·012509 | 10·144351 | 21 43 | 9·855649 | 18 | 30 |
| 11 | 44 | 9·843206 | 22 48 | 10·156794 | 9·987618 | 22 93 | 10·012382 | 10·144412 | 22 45 | 9·855588 | 16 | 49 |
| 30 | 46 | 9·843271 | 23 50 | 10·156729 | 9·987744 | 23 97 | 10·012256 | 10·144474 | 23 47 | 9·855526 | 14 | 30 |
| 12 | 48 | 9·843336 | 24 52 | 10·156664 | 9·987871 | 24 101 | 10·012129 | 10·144535 | 24 49 | 9·855465 | 12 | 48 |
| 30 | 50 | 9·843401 | 25 54 | 10·156599 | 9·987997 | 25 105 | 10·012003 | 10·144596 | 25 51 | 9·855404 | 10 | 30 |
| 13 | 52 | 9·843466 | 26 56 | 10·156534 | 9·988123 | 26 109 | 10·011877 | 10·144658 | 26 53 | 9·855342 | 8 | 47 |
| 30 | 54 | 9·843530 | 27 59 | 10·156470 | 9·988250 | 27 114 | 10·011750 | 10·144719 | 27 55 | 9·855281 | 6 | 30 |
| 14 | 56 | 9·843595 | 28 61 | 10·156405 | 9·988376 | 28 118 | 10·011624 | 10·144781 | 28 57 | 9·855219 | 4 | 46 |
| 30 | 58 | 9·843660 | 29 63 | 10·156340 | 9·988503 | 29 122 | 10·011497 | 10·144842 | 29 59 | 9·855158 | 2 | 30 |
| 15 | **57** | 9·843725 | 30 65 | 10·156275 | 9·988629 | 30 126 | 10·011371 | 10·144904 | 30 61 | 9·855096 | **3** | 45 |
| 30 | 2 | 9·843790 | 1 2 | 10·156210 | 9·988755 | 1 4 | 10·011245 | 10·144965 | 1 2 | 9·855035 | 58 | 30 |
| 16 | 4 | 9·843855 | 2 4 | 10·156145 | 9·988882 | 2 8 | 10·011118 | 10·145027 | 2 4 | 9·854973 | 56 | 44 |
| 30 | 6 | 9·843919 | 3 6 | 10·156081 | 9·989008 | 3 13 | 10·010992 | 10·145089 | 3 6 | 9·854911 | 54 | 30 |
| 17 | 8 | 9·843984 | 4 9 | 10·156016 | 9·989134 | 4 17 | 10·010866 | 10·145150 | 4 8 | 9·854850 | 52 | 43 |
| 30 | 10 | 9·844049 | 5 11 | 10·155951 | 9·989261 | 5 21 | 10·010739 | 10·145212 | 5 10 | 9·854788 | 50 | 30 |
| 18 | 12 | 9·844114 | 6 13 | 10·155886 | 9·989387 | 6 25 | 10·010613 | 10·145273 | 6 12 | 9·854727 | 48 | 42 |
| 30 | 14 | 9·844178 | 7 15 | 10·155822 | 9·989513 | 7 29 | 10·010487 | 10·145335 | 7 14 | 9·854665 | 46 | 30 |
| 19 | 16 | 9·844243 | 8 17 | 10·155757 | 9·989640 | 8 34 | 10·010360 | 10·145397 | 8 16 | 9·854603 | 44 | 41 |
| 30 | 18 | 9·844308 | 9 19 | 10·155692 | 9·989766 | 9 38 | 10·010234 | 10·145458 | 9 19 | 9·854542 | 42 | 30 |
| 20 | 20 | 9·844372 | 10 21 | 10·155628 | 9·989893 | 10 42 | 10·010107 | 10·145520 | 10 21 | 9·854480 | 40 | 40 |
| 30 | 22 | 9·844437 | 11 24 | 10·155563 | 9·990019 | 11 46 | 10·009981 | 10·145582 | 11 23 | 9·854418 | 38 | 30 |
| 21 | 24 | 9·844502 | 12 26 | 10·155498 | 9·990145 | 12 51 | 10·009855 | 10·145644 | 12 25 | 9·854356 | 36 | 39 |
| 30 | 26 | 9·844566 | 13 28 | 10·155434 | 9·990272 | 13 55 | 10·009728 | 10·145705 | 13 27 | 9·854295 | 34 | 30 |
| 22 | 28 | 9·844631 | 14 30 | 10·155369 | 9·990398 | 14 59 | 10·009602 | 10·145767 | 14 29 | 9·854233 | 32 | 38 |
| 30 | 30 | 9·844696 | 15 32 | 10·155304 | 9·990524 | 15 63 | 10·009476 | 10·145829 | 15 31 | 9·854171 | 30 | 30 |
| 23 | 32 | 9·844760 | 16 34 | 10·155240 | 9·990651 | 16 67 | 10·009349 | 10·145891 | 16 33 | 9·854109 | 28 | 37 |
| 30 | 34 | 9·844825 | 17 37 | 10·155175 | 9·990777 | 17 72 | 10·009223 | 10·145953 | 17 35 | 9·854047 | 26 | 30 |
| 24 | 36 | 9·844889 | 18 39 | 10·155111 | 9·990903 | 18 76 | 10·009097 | 10·146014 | 18 37 | 9·853986 | 24 | 36 |
| 30 | 38 | 9·844954 | 19 41 | 10·155046 | 9·991030 | 19 80 | 10·008970 | 10·146076 | 19 39 | 9·853924 | 22 | 30 |
| 25 | 40 | 9·845018 | 20 43 | 10·154982 | 9·991156 | 20 84 | 10·008844 | 10·146138 | 20 41 | 9·853862 | 20 | 35 |
| 30 | 42 | 9·845083 | 21 45 | 10·154917 | 9·991283 | 21 88 | 10·008717 | 10·146200 | 21 43 | 9·853800 | 18 | 30 |
| 26 | 44 | 9·845147 | 22 47 | 10·154853 | 9·991409 | 22 93 | 10·008591 | 10·146262 | 22 45 | 9·853738 | 16 | 34 |
| 30 | 46 | 9·845211 | 23 49 | 10·154789 | 9·991535 | 23 97 | 10·008465 | 10·146324 | 23 47 | 9·853676 | 14 | 30 |
| 27 | 48 | 9·845276 | 24 52 | 10·154724 | 9·991662 | 24 101 | 10·008338 | 10·146386 | 24 49 | 9·853614 | 12 | 33 |
| 30 | 50 | 9·845340 | 25 54 | 10·154660 | 9·991788 | 25 105 | 10·008212 | 10·146448 | 25 51 | 9·853552 | 10 | 30 |
| 28 | 52 | 9·845405 | 26 56 | 10·154595 | 9·991914 | 26 109 | 10·008086 | 10·146510 | 26 54 | 9·853490 | 8 | 32 |
| 30 | 54 | 9·845469 | 27 58 | 10·154531 | 9·992041 | 27 114 | 10·007959 | 10·146572 | 27 56 | 9·853428 | 6 | 30 |
| 29 | 56 | 9·845533 | 28 60 | 10·154467 | 9·992167 | 28 118 | 10·007833 | 10·146634 | 28 58 | 9·853366 | 4 | 31 |
| 30 | 58 | 9·845598 | 29 62 | 10·154402 | 9·992293 | 29 122 | 10·007707 | 10·146696 | 29 60 | 9·853304 | 2 | 30 |
| 30 | **58** | 9·845662 | 30 64 | 10·154338 | 9·992420 | 30 126 | 10·007580 | 10·146758 | 30 62 | 9·853242 | 0 | 30 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

45° $3^h$ $2^m$

TABLE XXVI.—(*continued*).

**LOG. SINES, COSINES, &c.**

2ʰ 58ᵐ — 44°

| ′ ″ | m. s. | Sine | Parts | Cosec. | Tangent | Parts | Cotang. | Secant | Parts | Cosine | m. s. | ′ ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 0 | 9·845662 | | 10·154338 | 9·992420 | | 10·007580 | 10·146758 | | 9·853242 | 2 | 30 |
| 30 | 2 | 9·845726 | 1″ 2 | 10·154274 | 9·992546 | 1″ 4 | 10·007454 | 10·146820 | 1″ 2 | 9·853180 | 58 | 30 |
| 31 | 4 | 9·845790 | 2 4 | 10·154210 | 9·992672 | 2 8 | 10·007328 | 10·146882 | 2 4 | 9·853118 | 56 | 29 |
| 30 | 6 | 9·845855 | 3 6 | 10·154145 | 9·992799 | 3 13 | 10·007201 | 10·146944 | 3 6 | 9·853056 | 54 | 30 |
| 32 | 8 | 9·845919 | 4 8 | 10·154081 | 9·992925 | 4 17 | 10·007075 | 10·147006 | 4 8 | 9·852994 | 52 | 28 |
| 30 | 10 | 9·845983 | 5 10 | 10·154017 | 9·993051 | 5 21 | 10·006949 | 10·147069 | 5 10 | 9·852931 | 50 | 30 |
| 33 | 12 | 9·846047 | 6 13 | 10·153953 | 9·993178 | 6 25 | 10·006822 | 10·147131 | 6 12 | 9·852869 | 48 | 27 |
| 30 | 14 | 9·846111 | 7 15 | 10·153889 | 9·993304 | 7 29 | 10·006696 | 10·147193 | 7 15 | 9·852807 | 46 | 30 |
| 34 | 16 | 9·846175 | 8 17 | 10·153825 | 9·993430 | 8 34 | 10·006570 | 10·147255 | 8 17 | 9·852745 | 44 | 26 |
| 30 | 18 | 9·846240 | 9 19 | 10·153760 | 9·993557 | 9 38 | 10·006443 | 10·147317 | 9 19 | 9·852683 | 42 | 30 |
| 35 | 20 | 9·846304 | 10 21 | 10·153696 | 9·993683 | 10 42 | 10·006317 | 10·147380 | 10 21 | 9·852620 | 40 | 25 |
| 30 | 22 | 9·846368 | 11 23 | 10·153632 | 9·993810 | 11 46 | 10·006190 | 10·147442 | 11 23 | 9·852558 | 38 | 30 |
| 36 | 24 | 9·846432 | 12 26 | 10·153568 | 9·993936 | 12 51 | 10·006064 | 10·147504 | 12 25 | 9·852496 | 36 | 24 |
| 30 | 26 | 9·846496 | 13 28 | 10·153504 | 9·994062 | 13 55 | 10·005938 | 10·147566 | 13 27 | 9·852434 | 34 | 30 |
| 37 | 28 | 9·846560 | 14 30 | 10·153440 | 9·994189 | 14 59 | 10·005811 | 10·147629 | 14 29 | 9·852371 | 32 | 23 |
| 30 | 30 | 9·846624 | 15 32 | 10·153376 | 9·994315 | 15 63 | 10·005685 | 10·147691 | 15 31 | 9·852309 | 30 | 30 |
| 38 | 32 | 9·846688 | 16 34 | 10·153312 | 9·994441 | 16 67 | 10·005559 | 10·147753 | 16 33 | 9·852247 | 28 | 22 |
| 30 | 34 | 9·846752 | 17 36 | 10·153248 | 9·994568 | 17 72 | 10·005432 | 10·147816 | 17 35 | 9·852184 | 26 | 30 |
| 39 | 36 | 9·846816 | 18 38 | 10·153184 | 9·994694 | 18 76 | 10·005306 | 10·147878 | 18 37 | 9·852122 | 24 | 21 |
| 30 | 38 | 9·846880 | 19 40 | 10·153120 | 9·994820 | 19 80 | 10·005180 | 10·147941 | 19 40 | 9·852059 | 22 | 30 |
| 40 | 40 | 9·846944 | 20 42 | 10·153056 | 9·994947 | 20 84 | 10·005053 | 10·148003 | 20 42 | 9·851997 | 20 | 20 |
| 30 | 42 | 9·847008 | 21 45 | 10·152992 | 9·995073 | 21 88 | 10·004927 | 10·148066 | 21 44 | 9·851934 | 18 | 30 |
| 41 | 44 | 9·847071 | 22 47 | 10·152929 | 9·995199 | 22 93 | 10·004801 | 10·148128 | 22 46 | 9·851872 | 16 | 19 |
| 30 | 46 | 9·847135 | 23 49 | 10·152865 | 9·995326 | 23 97 | 10·004674 | 10·148190 | 23 48 | 9·851810 | 14 | 30 |
| 42 | 48 | 9·847199 | 24 51 | 10·152801 | 9·995452 | 24 101 | 10·004548 | 10·148253 | 24 50 | 9·851747 | 12 | 18 |
| 30 | 50 | 9·847263 | 25 53 | 10·152737 | 9·995578 | 25 105 | 10·004422 | 10·148315 | 25 52 | 9·851685 | 10 | 30 |
| 43 | 52 | 9·847327 | 26 55 | 10·152673 | 9·995705 | 26 109 | 10·004295 | 10·148378 | 26 54 | 9·851622 | 8 | 17 |
| 30 | 54 | 9·847391 | 27 58 | 10·152609 | 9·995831 | 27 114 | 10·004169 | 10·148441 | 27 56 | 9·851559 | 6 | 30 |
| 44 | 56 | 9·847454 | 28 60 | 10·152546 | 9·995957 | 28 118 | 10·004043 | 10·148503 | 28 58 | 9·851497 | 4 | 16 |
| 30 | 58 | 9·847518 | 29 62 | 10·152482 | 9·996084 | 29 122 | 10·003916 | 10·148566 | 29 60 | 9·851434 | 2 | 30 |
| 45 | **59** | 9·847582 | 30 64 | 10·152418 | 9·996210 | 30 126 | 10·003790 | 10·148628 | 30 62 | 9·851372 | **1** | 15 |
| 30 | 2 | 9·847646 | 1 2 | 10·152354 | 9·996336 | 1 4 | 10·003664 | 10·148691 | 1 2 | 9·851309 | 58 | 30 |
| 46 | 4 | 9·847709 | 2 4 | 10·152291 | 9·996463 | 2 8 | 10·003537 | 10·148754 | 2 4 | 9·851246 | 56 | 14 |
| 30 | 6 | 9·847773 | 3 6 | 10·152227 | 9·996589 | 3 13 | 10·003411 | 10·148816 | 3 6 | 9·851184 | 54 | 30 |
| 47 | 8 | 9·847836 | 4 8 | 10·152164 | 9·996715 | 4 17 | 10·003285 | 10·148879 | 4 8 | 9·851121 | 52 | 13 |
| 30 | 10 | 9·847900 | 5 11 | 10·152100 | 9·996842 | 5 21 | 10·003158 | 10·148942 | 5 10 | 9·851058 | 50 | 30 |
| 48 | 12 | 9·847964 | 6 13 | 10·152036 | 9·996968 | 6 25 | 10·003032 | 10·149004 | 6 13 | 9·850996 | 48 | 12 |
| 30 | 14 | 9·848027 | 7 15 | 10·151973 | 9·997094 | 7 29 | 10·002906 | 10·149067 | 7 15 | 9·850933 | 46 | 30 |
| 49 | 16 | 9·848091 | 8 17 | 10·151909 | 9·997221 | 8 34 | 10·002779 | 10·149130 | 8 17 | 9·850870 | 44 | 11 |
| 30 | 18 | 9·848155 | 9 19 | 10·151845 | 9·997347 | 9 38 | 10·002653 | 10·149193 | 9 19 | 9·850807 | 42 | 30 |
| 50 | 20 | 9·848218 | 10 21 | 10·151782 | 9·997473 | 10 42 | 10·002527 | 10·149255 | 10 21 | 9·850745 | 40 | 10 |
| 30 | 22 | 9·848282 | 11 23 | 10·151718 | 9·997600 | 11 46 | 10·002400 | 10·149318 | 11 23 | 9·850682 | 38 | 30 |
| 51 | 24 | 9·848345 | 12 25 | 10·151655 | 9·997726 | 12 51 | 10·002274 | 10·149381 | 12 25 | 9·850619 | 36 | 9 |
| 30 | 26 | 9·848409 | 13 28 | 10·151591 | 9·997852 | 13 55 | 10·002148 | 10·149444 | 13 27 | 9·850556 | 34 | 30 |
| 52 | 28 | 9·848472 | 14 30 | 10·151528 | 9·997979 | 14 59 | 10·002021 | 10·149507 | 14 29 | 9·850493 | 32 | 8 |
| 30 | 30 | 9·848535 | 15 32 | 10·151465 | 9·998105 | 15 63 | 10·001895 | 10·149570 | 15 31 | 9·850430 | 30 | 30 |
| 53 | 32 | 9·848599 | 16 34 | 10·151401 | 9·998231 | 16 67 | 10·001769 | 10·149632 | 16 34 | 9·850368 | 28 | 7 |
| 30 | 34 | 9·848662 | 17 36 | 10·151338 | 9·998358 | 17 72 | 10·001642 | 10·149695 | 17 36 | 9·850305 | 26 | 30 |
| 54 | 36 | 9·848726 | 18 38 | 10·151274 | 9·998484 | 18 76 | 10·001516 | 10·149758 | 18 38 | 9·850242 | 24 | 6 |
| 30 | 38 | 9·848789 | 19 40 | 10·151211 | 9·998610 | 19 80 | 10·001390 | 10·149821 | 19 40 | 9·850179 | 22 | 30 |
| 55 | 40 | 9·848852 | 20 43 | 10·151148 | 9·998737 | 20 84 | 10·001263 | 10·149884 | 20 42 | 9·850116 | 20 | 5 |
| 30 | 42 | 9·848916 | 21 45 | 10·151084 | 9·998863 | 21 88 | 10·001137 | 10·149947 | 21 44 | 9·850053 | 18 | 30 |
| 56 | 44 | 9·848979 | 22 47 | 10·151021 | 9·998989 | 22 93 | 10·001011 | 10·150010 | 22 46 | 9·849990 | 16 | 4 |
| 30 | 46 | 9·849042 | 23 49 | 10·150958 | 9·999116 | 23 97 | 10·000884 | 10·150073 | 23 48 | 9·849927 | 14 | 30 |
| 57 | 48 | 9·849106 | 24 51 | 10·150894 | 9·999242 | 24 101 | 10·000758 | 10·150136 | 24 50 | 9·849864 | 12 | 3 |
| 30 | 50 | 9·849169 | 25 53 | 10·150831 | 9·999368 | 25 105 | 10·000632 | 10·150199 | 25 52 | 9·849801 | 10 | 30 |
| 58 | 52 | 9·849232 | 26 55 | 10·150768 | 9·999495 | 26 109 | 10·000505 | 10·150262 | 26 54 | 9·849738 | 8 | 2 |
| 30 | 54 | 9·849295 | 27 57 | 10·150705 | 9·999621 | 27 114 | 10·000379 | 10·150326 | 27 56 | 9·849674 | 6 | 30 |
| 59 | 56 | 9·849359 | 28 60 | 10·150641 | 9·999747 | 28 118 | 10·000253 | 10·150389 | 28 59 | 9·849611 | 4 | 1 |
| 30 | 58 | 9·849422 | 29 62 | 10·150578 | 9·999874 | 29 122 | 10·000126 | 10·150452 | 29 61 | 9·849548 | 2 | 30 |
| 60 | **60** | 9·849485 | 30 64 | 10·150515 | 10·000000 | 30 126 | 10·000000 | 10·150515 | 30 63 | 9·849485 | 0 | 0 |
| ′ ″ | m. s. | Cosine | Parts | Secant | Cotang. | Parts | Tangent | Cosec. | Parts | Sine | m. s. | ′ ″ |

45° — 3ʰ 0ᵐ

## TABLE XXVII.

### PROPORTIONAL LOGARITHMS

| sec. ″ | h m 0° 0′ | h m 0° 1′ | h m 0° 2′ | h m 0° 3′ | h m 0° 4′ | h m 0° 5′ | h m 0° 6′ | h m 0° 7′ | h m 0° 8′ | h m 0° 9′ | sec ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | 2·2553 | 1·9542 | 1·7782 | 1·6532 | 1·5563 | 1·4771 | 1·4102 | 1·3522 | 1·3010 | 0 |
| 1 | 4·0334 | 2·2481 | 1·9506 | 1·7757 | 1·6514 | 1·5549 | 1·4759 | 1·4091 | 1·3513 | 1·3002 | 1 |
| 2 | 3·7324 | 2·2410 | 1·9471 | 1·7734 | 1·6496 | 1·5534 | 1·4747 | 1·4081 | 1·3504 | 1·2994 | 2 |
| 3 | 3·5563 | 2·2341 | 1·9435 | 1·7710 | 1·6478 | 1·5520 | 1·4735 | 1·4071 | 1·3495 | 1·2986 | 3 |
| 4 | 3·4314 | 2·2272 | 1·9400 | 1·7686 | 1·6460 | 1·5505 | 1·4723 | 1·4061 | 1·3486 | 1·2978 | 4 |
| 5 | 3·3345 | 2·2205 | 1·9365 | 1·7663 | 1·6443 | 1·5491 | 1·4711 | 1·4050 | 1·3477 | 1·2970 | 5 |
| 6 | 3·2553 | 2·2139 | 1·9331 | 1·7639 | 1·6425 | 1·5477 | 1·4699 | 1·4040 | 1·3468 | 1·2962 | 6 |
| 7 | 3·1883 | 2·2073 | 1·9296 | 1·7616 | 1·6407 | 1·5463 | 1·4688 | 1·4030 | 1·3459 | 1·2954 | 7 |
| 8 | 3·1303 | 2·2009 | 1·9262 | 1·7593 | 1·6390 | 1·5449 | 1·4676 | 1·4020 | 1·3450 | 1·2946 | 8 |
| 9 | 3·0792 | 2·1946 | 1·9228 | 1·7570 | 1·6372 | 1·5435 | 1·4664 | 1·4010 | 1·3441 | 1·2939 | 9 |
| 10 | 3·0334 | 2·1883 | 1·9195 | 1·7547 | 1·6355 | 1·5421 | 1·4652 | 1·4000 | 1·3432 | 1·2931 | 10 |
| 11 | 2·9920 | 2·1822 | 1·9162 | 1·7524 | 1·6337 | 1·5407 | 1·4640 | 1·3989 | 1·3423 | 1·2923 | 11 |
| 12 | 2·9542 | 2·1761 | 1·9128 | 1·7501 | 1·6320 | 1·5393 | 1·4629 | 1·3979 | 1·3415 | 1·2915 | 12 |
| 13 | 2·9195 | 2·1701 | 1·9096 | 1·7479 | 1·6303 | 1·5379 | 1·4617 | 1·3969 | 1·3406 | 1·2907 | 13 |
| 14 | 2·8873 | 2 1642 | 1·9063 | 1·7456 | 1·6286 | 1·5365 | 1·4605 | 1·3959 | 1·3397 | 1·2899 | 14 |
| 15 | 2·8573 | 2·1584 | 1·9031 | 1·7434 | 1·6269 | 1·5351 | 1·4594 | 1·3949 | 1·3388 | 1·2891 | 15 |
| 16 | 2·8293 | 2·1526 | 1·8999 | 1·7412 | 1·6252 | 1·5337 | 1·4582 | 1·3939 | 1·3379 | 1·2883 | 16 |
| 17 | 2·8030 | 2·1469 | 1·8967 | 1·7390 | 1·6235 | 1·5324 | 1·4571 | 1·3929 | 1·3371 | 1·2876 | 17 |
| 18 | 2·7782 | 2·1413 | 1·8935 | 1·7368 | 1·6218 | 1·5310 | 1·4559 | 1·3919 | 1·3362 | 1·2868 | 18 |
| 19 | 2·7547 | 2·1358 | 1·8904 | 1·7346 | 1·6201 | 1·5296 | 1·4548 | 1·3910 | 1·3353 | 1·2860 | 19 |
| 20 | 2·7324 | 2·1303 | 1·8873 | 1·7324 | 1·6184 | 1·5283 | 1·4536 | 1·3900 | 1·3344 | 1·2852 | 20 |
| 21 | 2·7112 | 2·1249 | 1·8842 | 1·7302 | 1·6168 | 1·5269 | 1·4525 | 1·3890 | 1·3336 | 1·2845 | 21 |
| 22 | 2·6910 | 2·1196 | 1·8811 | 1·7281 | 1·6151 | 1·5256 | 1·4514 | 1·3880 | 1·3327 | 1·2837 | 22 |
| 23 | 2·6717 | 2·1143 | 1·8781 | 1·7259 | 1·6135 | 1·5242 | 1·4502 | 1·3870 | 1·3319 | 1·2829 | 23 |
| 24 | 2·6532 | 2·1091 | 1·8751 | 1·7238 | 1·6118 | 1·5229 | 1·4491 | 1·3860 | 1·3310 | 1·2821 | 24 |
| 25 | 2·6355 | 2·1040 | 1·8721 | 1·7217 | 1·6102 | 1·5215 | 1·4480 | 1·3851 | 1·3301 | 1·2814 | 25 |
| 26 | 2·6184 | 2·0989 | 1·8691 | 1·7196 | 1·6085 | 1·5202 | 1·4468 | 1·3841 | 1·3293 | 1·2806 | 26 |
| 27 | 2·6021 | 2·0939 | 1·8661 | 1·7175 | 1·6069 | 1·5189 | 1·4457 | 1·3831 | 1·3284 | 1·2798 | 27 |
| 28 | 2·5863 | 2·0889 | 1·8632 | 1·7154 | 1·6053 | 1·5175 | 1·4446 | 1·3821 | 1·3276 | 1·2791 | 28 |
| 29 | 2·5710 | 2·0840 | 1·8602 | 1·7133 | 1·6037 | 1·5162 | 1·4435 | 1·3812 | 1·3267 | 1·2783 | 29 |
| 30 | 2·5563 | 2·0792 | 1·8573 | 1·7112 | 1·6021 | 1·5149 | 1·4424 | 1·3802 | 1·3259 | 1·2775 | 30 |
| 31 | 2·5421 | 2·0744 | 1·8544 | 1·7091 | 1·6004 | 1·5136 | 1·4412 | 1·3792 | 1·3250 | 1·2768 | 31 |
| 32 | 2·5283 | 2·0696 | 1·8516 | 1·7071 | 1·5988 | 1·5123 | 1·4401 | 1·3783 | 1·3241 | 1·2760 | 32 |
| 33 | 2·5149 | 2·0649 | 1·8487 | 1·7050 | 1·5973 | 1·5110 | 1·4390 | 1·3773 | 1·3233 | 1·2753 | 33 |
| 34 | 2·5019 | 2·0603 | 1·8459 | 1·7030 | 1·5957 | 1·5097 | 1·4379 | 1·3764 | 1·3225 | 1·2745 | 34 |
| 35 | 2·4894 | 2·0557 | 1·8431 | 1·7010 | 1·5941 | 1·5084 | 1·4368 | 1·3754 | 1·3216 | 1·2738 | 35 |
| 36 | 2·4771 | 2·0512 | 1·8403 | 1·6990 | 1·5925 | 1·5071 | 1·4357 | 1·3745 | 1·3208 | 1·2730 | 36 |
| 37 | 2·4652 | 2·0467 | 1·8375 | 1·6970 | 1·5909 | 1·5058 | 1·4346 | 1·3735 | 1·3199 | 1·2722 | 37 |
| 38 | 2·4536 | 2·0422 | 1·8348 | 1·6950 | 1·5894 | 1·5045 | 1·4335 | 1·3726 | 1·3191 | 1·2715 | 38 |
| 39 | 2·4424 | 2·0378 | 1·8320 | 1·6930 | 1·5878 | 1·5032 | 1·4325 | 1·3716 | 1·3183 | 1·2707 | 39 |
| 40 | 2·4314 | 2·0334 | 1·8293 | 1·6910 | 1·5863 | 1·5019 | 1·4314 | 1·3707 | 1·3174 | 1·2700 | 40 |
| 41 | 2·4206 | 2·0291 | 1·8266 | 1·6890 | 1·5847 | 1·5007 | 1·4303 | 1·3697 | 1·3166 | 1·2692 | 41 |
| 42 | 2·4102 | 2·0248 | 1·8239 | 1·6871 | 1·5832 | 1·4994 | 1·4292 | 1·3688 | 1·3158 | 1·2685 | 42 |
| 43 | 2·4000 | 2·0206 | 1·8212 | 1·6851 | 1·5816 | 1·4981 | 1·4281 | 1·3678 | 1·3149 | 1·2678 | 43 |
| 44 | 2·3900 | 2·0164 | 1·8186 | 1·6832 | 1·5801 | 1·4969 | 1·4270 | 1·3669 | 1·3141 | 1·2670 | 44 |
| 45 | 2·3802 | 2·0122 | 1·8159 | 1·6812 | 1·5786 | 1·4956 | 1·4260 | 1·3660 | 1·3133 | 1·2663 | 45 |
| 46 | 2·3707 | 2·0081 | 1·8133 | 1·6793 | 1·5771 | 1·4943 | 1·4249 | 1·3650 | 1·3124 | 1·2655 | 46 |
| 47 | 2·3613 | 2·0040 | 1·8107 | 1·6774 | 1·5755 | 1·4931 | 1·4238 | 1·3641 | 1·3116 | 1·2648 | 47 |
| 48 | 2·3522 | 2·0000 | 1·8081 | 1·6755 | 1·5740 | 1·4918 | 1·4228 | 1·3632 | 1·3108 | 1·2640 | 48 |
| 49 | 2·3432 | 1·9960 | 1·8055 | 1·6736 | 1·5725 | 1·4906 | 1·4217 | 1·3622 | 1·3100 | 1·2633 | 49 |
| 50 | 2·3345 | 1·9920 | 1·8030 | 1·6717 | 1·5710 | 1·4894 | 1·4206 | 1·3613 | 1·3091 | 1·2626 | 50 |
| 51 | 2·3259 | 1·9881 | 1·8004 | 1·6698 | 1·5695 | 1·4881 | 1·4196 | 1·3604 | 1·3083 | 1·2618 | 51 |
| 52 | 2·3174 | 1·9842 | 1·7979 | 1·6679 | 1·5680 | 1·4869 | 1·4185 | 1·3595 | 1·3075 | 1·2611 | 52 |
| 53 | 2·3091 | 1·9803 | 1·7954 | 1·6661 | 1·5666 | 1·4856 | 1·4175 | 1·3586 | 1·3067 | 1·2604 | 53 |
| 54 | 2·3010 | 1·9765 | 1·7929 | 1·6642 | 1·5651 | 1·4844 | 1·4164 | 1·3576 | 1·3059 | 1·2596 | 54 |
| 55 | 2·2931 | 1·9727 | 1·7904 | 1·6624 | 1·5636 | 1·4832 | 1·4154 | 1·3567 | 1·3051 | 1·2589 | 55 |
| 56 | 2·2852 | 1·9690 | 1·7879 | 1·6605 | 1·5621 | 1·4820 | 1·4143 | 1·3558 | 1·3043 | 1·2582 | 56 |
| 57 | 2·2775 | 1·9652 | 1·7855 | 1·6587 | 1·5607 | 1·4808 | 1·4133 | 1·3549 | 1·3034 | 1·2574 | 57 |
| 58 | 2·2700 | 1·9615 | 1·7830 | 1·6568 | 1·5592 | 1·4795 | 1·4122 | 1·3540 | 1·3026 | 1·2567 | 58 |
| 59 | 2·2626 | 1·9579 | 1·7806 | 1·6550 | 1·5577 | 1·4783 | 1·4112 | 1·3531 | 1·3018 | 1·2560 | 59 |
| 60 | 2·2553 | 1·9542 | 1·7782 | 1·6532 | 1·5563 | 1·4771 | 1·4102 | 1·3522 | 1·3010 | 1·2553 | 60 |

TABLE XXVII.—(*continued*).

## PROPORTIONAL LOGARITHMS

| sec. ″ | h m 0° 10′ | h m 0° 11′ | h m 0° 12′ | h m 0° 13′ | h m 0° 14′ | h m 0° 15′ | h m 0° 16′ | h m 0° 17′ | h m 0° 18′ | h m 0° 19′ | h m 0° 20′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1·2553 | 1·2139 | 1·1761 | 1·1413 | 1·1091 | 1·0792 | 1·0512 | 1·0248 | 1·0000 | 9765 | 9542 | 0 |
| 1 | 1·2545 | 1·2132 | 1·1755 | 1·1408 | 1·1086 | 1·0787 | 1·0507 | 1·0244 | 0·9996 | 9761 | 9539 | 1 |
| 2 | 1·2538 | 1·2126 | 1·1749 | 1·1402 | 1·1081 | 1·0782 | 1·0502 | 1·0240 | 0·9992 | 9758 | 9535 | 2 |
| 3 | 1·2531 | 1·2119 | 1·1743 | 1·1397 | 1·1076 | 1·0777 | 1·0498 | 1·0235 | 0·9988 | 9754 | 9532 | 3 |
| 4 | 1·2524 | 1·2113 | 1·1737 | 1·1391 | 1·1071 | 1·0773 | 1·0493 | 1·0231 | 0·9984 | 9750 | 9528 | 4 |
| 5 | 1·2517 | 1·2106 | 1·1731 | 1·1385 | 1·1066 | 1·0768 | 1·0489 | 1·0227 | 0·9980 | 9746 | 9524 | 5 |
| 6 | 1·2510 | 1·2099 | 1·1725 | 1·1380 | 1·1061 | 1·0763 | 1·0484 | 1·0223 | 0·9976 | 9742 | 9521 | 6 |
| 7 | 1·2502 | 1·2093 | 1·1719 | 1·1374 | 1·1055 | 1·0758 | 1·0480 | 1·0218 | 0·9972 | 9739 | 9517 | 7 |
| 8 | 1·2495 | 1·2086 | 1·1713 | 1·1369 | 1·1050 | 1·0753 | 1·0475 | 1·0214 | 0·9968 | 9735 | 9514 | 8 |
| 9 | 1·2488 | 1·2080 | 1·1707 | 1·1363 | 1·1045 | 1·0749 | 1·0471 | 1·0210 | 0·9964 | 9731 | 9510 | 9 |
| 10 | 1·2481 | 1·2073 | 1·1701 | 1·1358 | 1·1040 | 1·0744 | 1·0467 | 1·0206 | 0·9960 | 9727 | 9506 | 10 |
| 11 | 1·2474 | 1·2067 | 1·1695 | 1·1352 | 1·1035 | 1·0739 | 1·0462 | 1·0202 | 0·9956 | 9723 | 9503 | 11 |
| 12 | 1·2467 | 1·2061 | 1·1689 | 1·1347 | 1·1030 | 1·0734 | 1·0458 | 1·0197 | 0·9952 | 9720 | 9499 | 12 |
| 13 | 1·2460 | 1·2054 | 1·1683 | 1·1341 | 1·1025 | 1·0729 | 1·0453 | 1·0193 | 0·9948 | 9716 | 9496 | 13 |
| 14 | 1·2453 | 1·2048 | 1·1677 | 1·1336 | 1·1020 | 1·0725 | 1·0449 | 1·0189 | 0·9944 | 9712 | 9492 | 14 |
| 15 | 1·2445 | 1·2041 | 1·1671 | 1·1331 | 1·1015 | 1·0720 | 1·0444 | 1·0185 | 0·9940 | 9708 | 9488 | 15 |
| 16 | 1·2438 | 1·2035 | 1·1665 | 1·1325 | 1·1009 | 1·0715 | 1·0440 | 1·0181 | 0·9936 | 9705 | 9485 | 16 |
| 17 | 1·2431 | 1·2028 | 1·1660 | 1·1320 | 1·1004 | 1·0710 | 1·0435 | 1·0176 | 0·9932 | 9701 | 9481 | 17 |
| 18 | 1·2424 | 1·2022 | 1·1654 | 1·1314 | 1·0999 | 1·0706 | 1·0431 | 1·0172 | 0·9928 | 9697 | 9478 | 18 |
| 19 | 1·2417 | 1·2015 | 1·1648 | 1·1309 | 1·0994 | 1·0701 | 1·0426 | 1·0168 | 0·9924 | 9693 | 9474 | 19 |
| 20 | 1·2410 | 1·2009 | 1·1642 | 1·1303 | 1·0989 | 1·0696 | 1·0422 | 1·0164 | 0·9920 | 9690 | 9471 | 20 |
| 21 | 1·2403 | 1·2003 | 1·1636 | 1·1298 | 1·0984 | 1·0692 | 1·0418 | 1·0160 | 0·9916 | 9686 | 9467 | 21 |
| 22 | 1·2396 | 1·1996 | 1·1630 | 1·1292 | 1·0979 | 1·0687 | 1·0413 | 1·0156 | 0·9912 | 9682 | 9464 | 22 |
| 23 | 1·2389 | 1·1990 | 1·1624 | 1·1287 | 1·0974 | 1·0682 | 1·0409 | 1·0151 | 0·9908 | 9678 | 9460 | 23 |
| 24 | 1·2382 | 1·1984 | 1·1619 | 1·1282 | 1·0969 | 1·0678 | 1·0404 | 1·0147 | 0·9905 | 9675 | 9456 | 24 |
| 25 | 1·2375 | 1·1977 | 1·1613 | 1·1276 | 1·0964 | 1·0673 | 1·0400 | 1·0143 | 0·9901 | 9671 | 9453 | 25 |
| 26 | 1·2368 | 1·1971 | 1·1607 | 1·1271 | 1·0959 | 1·0668 | 1·0395 | 1·0139 | 0·9897 | 9667 | 9449 | 26 |
| 27 | 1·2362 | 1·1965 | 1·1601 | 1·1266 | 1·0954 | 1·0663 | 1·0391 | 1·0135 | 0·9893 | 9664 | 9446 | 27 |
| 28 | 1·2355 | 1·1958 | 1·1595 | 1·1260 | 1·0949 | 1·0659 | 1·0387 | 1·0131 | 0·9889 | 9660 | 9442 | 28 |
| 29 | 1·2348 | 1·1952 | 1·1589 | 1·1255 | 1·0944 | 1·0654 | 1·0382 | 1·0126 | 0·9885 | 9656 | 9439 | 29 |
| 30 | 1·2341 | 1·1946 | 1·1584 | 1·1249 | 1·0939 | 1·0649 | 1·0378 | 1·0122 | 0·9881 | 9652 | 9435 | 30 |
| 31 | 1·2334 | 1·1939 | 1·1578 | 1·1244 | 1·0934 | 1·0645 | 1·0373 | 1·0118 | 0·9877 | 9649 | 9432 | 31 |
| 32 | 1·2327 | 1·1933 | 1·1572 | 1·1239 | 1·0929 | 1·0640 | 1·0369 | 1·0114 | 0·9873 | 9645 | 9428 | 32 |
| 33 | 1·2320 | 1·1927 | 1·1566 | 1·1233 | 1·0924 | 1·0635 | 1·0365 | 1·0110 | 0·9869 | 9641 | 9425 | 33 |
| 34 | 1·2313 | 1·1921 | 1·1560 | 1·1228 | 1·0919 | 1·0631 | 1·0360 | 1·0106 | 0·9865 | 9638 | 9421 | 34 |
| 35 | 1·2306 | 1·1914 | 1·1555 | 1·1223 | 1·0914 | 1·0626 | 1·0356 | 1·0102 | 0·9861 | 9634 | 9418 | 35 |
| 36 | 1·2300 | 1·1908 | 1·1549 | 1·1217 | 1·0909 | 1·0621 | 1·0352 | 1·0098 | 0·9858 | 9630 | 9414 | 36 |
| 37 | 1·2293 | 1·1902 | 1·1543 | 1·1212 | 1·0904 | 1·0617 | 1·0347 | 1·0093 | 0·9854 | 9626 | 9410 | 37 |
| 38 | 1·2286 | 1·1896 | 1·1537 | 1·1207 | 1·0899 | 1·0612 | 1·0343 | 1·0089 | 0·9850 | 9623 | 9407 | 38 |
| 39 | 1·2279 | 1·1889 | 1·1532 | 1·1201 | 1·0894 | 1·0608 | 1·0339 | 1·0085 | 0·9846 | 9619 | 9404 | 39 |
| 40 | 1·2272 | 1·1883 | 1·1526 | 1·1196 | 1·0889 | 1·0603 | 1·0334 | 1·0081 | 0·9842 | 9615 | 9400 | 40 |
| 41 | 1·2266 | 1·1877 | 1·1520 | 1·1191 | 1·0884 | 1·0598 | 1·0330 | 1·0077 | 0·9838 | 9612 | 9396 | 41 |
| 42 | 1·2259 | 1·1871 | 1·1515 | 1·1186 | 1·0880 | 1·0594 | 1·0326 | 1·0073 | 0·9834 | 9608 | 9393 | 42 |
| 43 | 1·2252 | 1·1865 | 1·1509 | 1·1180 | 1·0875 | 1·0589 | 1·0321 | 1·0069 | 0·9830 | 9604 | 9389 | 43 |
| 44 | 1·2245 | 1·1858 | 1·1503 | 1·1175 | 1·0870 | 1·0584 | 1·0317 | 1·0065 | 0·9827 | 9601 | 9386 | 44 |
| 45 | 1·2239 | 1·1852 | 1·1498 | 1·1170 | 1·0865 | 1·0580 | 1·0313 | 1·0061 | 0·9823 | 9597 | 9383 | 45 |
| 46 | 1·2232 | 1·1846 | 1·1492 | 1·1164 | 1·0860 | 1·0575 | 1·0308 | 1·0057 | 0·9819 | 9593 | 9379 | 46 |
| 47 | 1·2225 | 1·1840 | 1·1486 | 1·1159 | 1·0855 | 1·0571 | 1·0304 | 1·0053 | 0·9815 | 9590 | 9376 | 47 |
| 48 | 1·2218 | 1·1834 | 1·1481 | 1·1154 | 1·0850 | 1·0566 | 1·0300 | 1·0049 | 0·9811 | 9586 | 9372 | 48 |
| 49 | 1·2212 | 1·1828 | 1·1475 | 1·1149 | 1·0845 | 1·0562 | 1·0295 | 1·0044 | 0·9807 | 9582 | 9369 | 49 |
| 50 | 1·2205 | 1·1822 | 1·1469 | 1·1143 | 1·0840 | 1·0557 | 1·0291 | 1·0040 | 0·9803 | 9579 | 9365 | 50 |
| 51 | 1·2198 | 1·1816 | 1·1464 | 1·1138 | 1·0835 | 1·0552 | 1·0287 | 1·0036 | 0·9800 | 9575 | 9362 | 51 |
| 52 | 1·2192 | 1·1809 | 1·1458 | 1·1133 | 1·0831 | 1·0548 | 1·0282 | 1·0032 | 0·9796 | 9571 | 9358 | 52 |
| 53 | 1·2185 | 1·1803 | 1·1452 | 1·1128 | 1·0826 | 1·0543 | 1·0278 | 1·0028 | 0·9792 | 9568 | 9355 | 53 |
| 54 | 1·2178 | 1·1797 | 1·1447 | 1·1123 | 1·0821 | 1·0539 | 1·0274 | 1·0024 | 0·9788 | 9564 | 9351 | 54 |
| 55 | 1·2172 | 1·1791 | 1·1441 | 1·1117 | 1·0816 | 1·0534 | 1·0270 | 1·0020 | 0·9784 | 9561 | 9348 | 55 |
| 56 | 1·2165 | 1·1785 | 1·1436 | 1·1112 | 1·0811 | 1·0530 | 1·0265 | 1·0016 | 0·9780 | 9557 | 9344 | 56 |
| 57 | 1·2159 | 1·1779 | 1·1430 | 1·1107 | 1·0806 | 1·0525 | 1·0261 | 1·0012 | 0·9777 | 9553 | 9341 | 57 |
| 58 | 1·2152 | 1·1773 | 1·1424 | 1·1102 | 1·0801 | 1·0521 | 1·0257 | 1·0008 | 0·9773 | 9550 | 9337 | 58 |
| 59 | 1·2145 | 1·1767 | 1·1419 | 1·1097 | 1·0797 | 1·0516 | 1·0252 | 1·0004 | 0·9769 | 9546 | 9334 | 59 |
| 60 | 1·2139 | 1·1761 | 1·1413 | 1·1091 | 1·0792 | 1·0512 | 1·0248 | 1·0000 | 0·9765 | 9542 | 9331 | 60 |

TABLE XXVII.—(*continued*).

**PROPORTIONAL LOGARITHMS**

| sec. ″ | h m 0° 21′ | h m 0° 22′ | h m 0° 23′ | h m 0° 24′ | h m 0° 25′ | h m 0° 26′ | h m 0° 27′ | h m 0° 28′ | h m 0° 29′ | h m 0° 30′ | h m 0° 31′ | h m 0° 32′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 9331 | 9128 | 8935 | 8751 | 8573 | 8403 | 8239 | 8081 | 7929 | 7782 | 7639 | 7501 | 0 |
| 1 | 9327 | 9125 | 8932 | 8748 | 8570 | 8400 | 8236 | 8079 | 7926 | 7779 | 7637 | 7499 | 1 |
| 2 | 9324 | 9122 | 8929 | 8745 | 8567 | 8397 | 8234 | 8076 | 7924 | 7777 | 7634 | 7497 | 2 |
| 3 | 9320 | 9119 | 8926 | 8742 | 8565 | 8395 | 8231 | 8073 | 7921 | 7774 | 7632 | 7494 | 3 |
| 4 | 9317 | 9115 | 8923 | 8739 | 8562 | 8392 | 8228 | 8071 | 7919 | 7772 | 7630 | 7492 | 4 |
| 5 | 9313 | 9112 | 8920 | 8736 | 8559 | 8389 | 8226 | 8068 | 7916 | 7769 | 7627 | 7490 | 5 |
| 6 | 9310 | 9109 | 8917 | 8733 | 8556 | 8386 | 8223 | 8066 | 7914 | 7767 | 7625 | 7488 | 6 |
| 7 | 9306 | 9105 | 8913 | 8730 | 8553 | 8383 | 8220 | 8063 | 7911 | 7765 | 7623 | 7485 | 7 |
| 8 | 9303 | 9102 | 8910 | 8727 | 8550 | 8381 | 8218 | 8060 | 7909 | 7762 | 7620 | 7483 | 8 |
| 9 | 9300 | 9099 | 8907 | 8724 | 8547 | 8378 | 8215 | 8058 | 7906 | 7760 | 7618 | 7481 | 9 |
| 10 | 9296 | 9096 | 8904 | 8721 | 8544 | 8375 | 8212 | 8055 | 7904 | 7757 | 7616 | 7479 | 10 |
| 11 | 9293 | 9092 | 8901 | 8718 | 8542 | 8372 | 8210 | 8053 | 7901 | 7755 | 7613 | 7476 | 11 |
| 12 | 9289 | 9089 | 8898 | 8715 | 8539 | 8370 | 8207 | 8050 | 7899 | 7753 | 7611 | 7474 | 12 |
| 13 | 9286 | 9086 | 8895 | 8712 | 8536 | 8367 | 8204 | 8048 | 7896 | 7750 | 7609 | 7472 | 13 |
| 14 | 9283 | 9083 | 8892 | 8709 | 8533 | 8364 | 8202 | 8045 | 7894 | 7748 | 7606 | 7470 | 14 |
| 15 | 9279 | 9079 | 8888 | 8706 | 8530 | 8361 | 8199 | 8043 | 7891 | 7745 | 7604 | 7467 | 15 |
| 16 | 9276 | 9076 | 8885 | 8703 | 8527 | 8359 | 8196 | 8040 | 7889 | 7743 | 7602 | 7465 | 16 |
| 17 | 9272 | 9073 | 8882 | 8700 | 8524 | 8356 | 8194 | 8037 | 7886 | 7741 | 7600 | 7463 | 17 |
| 18 | 9269 | 9070 | 8879 | 8697 | 8522 | 8353 | 8191 | 8035 | 7884 | 7738 | 7597 | 7461 | 18 |
| 19 | 9265 | 9066 | 8876 | 8694 | 8519 | 8350 | 8188 | 8032 | 7882 | 7736 | 7595 | 7458 | 19 |
| 20 | 9262 | 9063 | 8873 | 8691 | 8516 | 8348 | 8186 | 8030 | 7879 | 7734 | 7593 | 7456 | 20 |
| 21 | 9259 | 9060 | 8870 | 8688 | 8513 | 8345 | 8183 | 8027 | 7877 | 7731 | 7590 | 7454 | 21 |
| 22 | 9255 | 9057 | 8867 | 8685 | 8510 | 8342 | 8180 | 8025 | 7874 | 7729 | 7588 | 7452 | 22 |
| 23 | 9252 | 9053 | 8864 | 8682 | 8507 | 8339 | 8178 | 8022 | 7872 | 7726 | 7586 | 7449 | 23 |
| 24 | 9249 | 9050 | 8861 | 8679 | 8504 | 8337 | 8175 | 8020 | 7869 | 7724 | 7583 | 7447 | 24 |
| 25 | 9245 | 9047 | 8857 | 8676 | 8501 | 8334 | 8173 | 8017 | 7867 | 7722 | 7581 | 7445 | 25 |
| 26 | 9242 | 9044 | 8854 | 8673 | 8499 | 8331 | 8170 | 8014 | 7864 | 7719 | 7579 | 7443 | 26 |
| 27 | 9238 | 9041 | 8851 | 8670 | 8496 | 8328 | 8167 | 8012 | 7862 | 7717 | 7577 | 7441 | 27 |
| 28 | 9235 | 9037 | 8848 | 8667 | 8493 | 8326 | 8165 | 8009 | 7859 | 7714 | 7574 | 7438 | 28 |
| 29 | 9232 | 9034 | 8845 | 8664 | 8490 | 8323 | 8162 | 8007 | 7857 | 7712 | 7572 | 7436 | 29 |
| 30 | 9228 | 9031 | 8842 | 8661 | 8487 | 8320 | 8159 | 8004 | 7855 | 7710 | 7570 | 7434 | 30 |
| 31 | 9225 | 9028 | 8839 | 8658 | 8484 | 8317 | 8157 | 8002 | 7852 | 7707 | 7567 | 7432 | 31 |
| 32 | 9222 | 9024 | 8836 | 8655 | 8482 | 8315 | 8154 | 7999 | 7850 | 7705 | 7565 | 7429 | 32 |
| 33 | 9218 | 9021 | 8833 | 8652 | 8479 | 8312 | 8152 | 7997 | 7847 | 7703 | 7563 | 7427 | 33 |
| 34 | 9215 | 9018 | 8830 | 8649 | 8476 | 8309 | 8149 | 7994 | 7845 | 7700 | 7560 | 7425 | 34 |
| 35 | 9211 | 9015 | 8827 | 8646 | 8473 | 8307 | 8146 | 7992 | 7842 | 7698 | 7558 | 7423 | 35 |
| 36 | 9208 | 9012 | 8824 | 8643 | 8470 | 8304 | 8144 | 7989 | 7840 | 7696 | 7556 | 7421 | 36 |
| 37 | 9205 | 9008 | 8820 | 8640 | 8467 | 8301 | 8141 | 7986 | 7837 | 7693 | 7554 | 7418 | 37 |
| 38 | 9201 | 9005 | 8817 | 8637 | 8465 | 8298 | 8138 | 7984 | 7835 | 7691 | 7551 | 7416 | 38 |
| 39 | 9198 | 9002 | 8814 | 8635 | 8462 | 8296 | 8136 | 7981 | 7832 | 7688 | 7549 | 7414 | 39 |
| 40 | 9195 | 8999 | 8811 | 8632 | 8459 | 8293 | 8133 | 7979 | 7830 | 7686 | 7547 | 7412 | 40 |
| 41 | 9191 | 8996 | 8808 | 8629 | 8456 | 8290 | 8130 | 7976 | 7828 | 7684 | 7544 | 7409 | 41 |
| 42 | 9188 | 8992 | 8805 | 8626 | 8453 | 8288 | 8128 | 7974 | 7825 | 7681 | 7542 | 7407 | 42 |
| 43 | 9185 | 8989 | 8802 | 8623 | 8451 | 8285 | 8125 | 7971 | 7823 | 7679 | 7540 | 7405 | 43 |
| 44 | 9181 | 8986 | 8799 | 8620 | 8448 | 8282 | 8123 | 7969 | 7820 | 7677 | 7538 | 7403 | 44 |
| 45 | 9178 | 8983 | 8796 | 8617 | 8445 | 8279 | 8120 | 7966 | 7818 | 7674 | 7535 | 7401 | 45 |
| 46 | 9175 | 8980 | 8793 | 8614 | 8442 | 8277 | 8117 | 7964 | 7815 | 7672 | 7533 | 7398 | 46 |
| 47 | 9171 | 8977 | 8790 | 8611 | 8439 | 8274 | 8115 | 7961 | 7813 | 7670 | 7531 | 7396 | 47 |
| 48 | 9168 | 8973 | 8787 | 8608 | 8437 | 8271 | 8112 | 7959 | 7811 | 7667 | 7528 | 7394 | 48 |
| 49 | 9165 | 8970 | 8784 | 8605 | 8434 | 8269 | 8110 | 7956 | 7808 | 7665 | 7526 | 7392 | 49 |
| 50 | 9161 | 8967 | 8781 | 8602 | 8431 | 8266 | 8107 | 7954 | 7806 | 7662 | 7524 | 7390 | 50 |
| 51 | 9158 | 8964 | 8778 | 8599 | 8428 | 8263 | 8104 | 7951 | 7803 | 7660 | 7522 | 7387 | 51 |
| 52 | 9155 | 8961 | 8775 | 8596 | 8425 | 8261 | 8102 | 7949 | 7801 | 7658 | 7519 | 7385 | 52 |
| 53 | 9152 | 8957 | 8772 | 8594 | 8422 | 8258 | 8099 | 7946 | 7798 | 7655 | 7517 | 7383 | 53 |
| 54 | 9148 | 8954 | 8769 | 8591 | 8420 | 8255 | 8097 | 7944 | 7796 | 7653 | 7515 | 7381 | 54 |
| 55 | 9145 | 8951 | 8766 | 8588 | 8417 | 8252 | 8094 | 7941 | 7794 | 7651 | 7513 | 7379 | 55 |
| 56 | 9142 | 8948 | 8763 | 8585 | 8414 | 8250 | 8091 | 7939 | 7791 | 7648 | 7510 | 7376 | 56 |
| 57 | 9138 | 8945 | 8760 | 8582 | 8411 | 8247 | 8089 | 7936 | 7789 | 7646 | 7508 | 7374 | 57 |
| 58 | 9135 | 8942 | 8757 | 8579 | 8409 | 8244 | 8086 | 7934 | 7786 | 7644 | 7506 | 7372 | 58 |
| 59 | 9132 | 8939 | 8754 | 8576 | 8406 | 8242 | 8084 | 7931 | 7784 | 7641 | 7503 | 7370 | 59 |
| 60 | 9128 | 8935 | 8751 | 8573 | 8403 | 8239 | 8081 | 7929 | 7782 | 7639 | 7501 | 7368 | 60 |

TABLE XXVII.—(*continued*).

## PROPORTIONAL LOGARITHMS

| sec. ″ | h m 0° 33′ | h m 0° 34′ | h m 0° 35′ | h m 0° 36′ | h m 0° 37′ | h m 0° 38′ | h m 0° 39′ | h m 0° 40′ | h m 0° 41′ | h m 0° 42′ | h m 0° 43′ | h m 0° 44′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 7368 | 7238 | 7112 | 6990 | 6871 | 6755 | 6642 | 6532 | 6425 | 6320 | 6218 | 6118 | 0 |
| 1 | 7365 | 7236 | 7110 | 6988 | 6869 | 6753 | 6640 | 6530 | 6423 | 6318 | 6216 | 6117 | 1 |
| 2 | 7363 | 7234 | 7108 | 6986 | 6867 | 6751 | 6638 | 6528 | 6421 | 6317 | 6215 | 6115 | 2 |
| 3 | 7361 | 7232 | 7106 | 6984 | 6865 | 6749 | 6637 | 6527 | 6420 | 6315 | 6213 | 6113 | 3 |
| 4 | 7359 | 7229 | 7104 | 6982 | 6863 | 6747 | 6635 | 6525 | 6418 | 6313 | 6211 | 6112 | 4 |
| 5 | 7357 | 7227 | 7102 | 6980 | 6861 | 6745 | 6633 | 6523 | 6416 | 6312 | 6210 | 6110 | 5 |
| 6 | 7354 | 7225 | 7100 | 6978 | 6859 | 6743 | 6631 | 6521 | 6414 | 6310 | 6208 | 6108 | 6 |
| 7 | 7352 | 7223 | 7098 | 6976 | 6857 | 6742 | 6629 | 6519 | 6412 | 6308 | 6206 | 6107 | 7 |
| 8 | 7350 | 7221 | 7095 | 6974 | 6855 | 6740 | 6627 | 6518 | 6411 | 6306 | 6205 | 6105 | 8 |
| 9 | 7348 | 7219 | 7093 | 6972 | 6853 | 6738 | 6625 | 6516 | 6409 | 6305 | 6203 | 6103 | 9 |
| 10 | 7346 | 7217 | 7091 | 6970 | 6851 | 6736 | 6624 | 6514 | 6407 | 6303 | 6201 | 6102 | 10 |
| 11 | 7343 | 7215 | 7089 | 6968 | 6849 | 6734 | 6622 | 6512 | 6405 | 6301 | 6200 | 6100 | 11 |
| 12 | 7341 | 7212 | 7087 | 6966 | 6847 | 6732 | 6620 | 6510 | 6404 | 6300 | 6198 | 6099 | 12 |
| 13 | 7339 | 7210 | 7085 | 6964 | 6845 | 6730 | 6618 | 6509 | 6402 | 6298 | 6196 | 6097 | 13 |
| 14 | 7337 | 7208 | 7083 | 6962 | 6843 | 6728 | 6616 | 6507 | 6400 | 6296 | 6194 | 6095 | 14 |
| 15 | 7335 | 7206 | 7081 | 6960 | 6841 | 6726 | 6614 | 6505 | 6398 | 6294 | 6193 | 6094 | 15 |
| 16 | 7333 | 7204 | 7079 | 6958 | 6839 | 6724 | 6612 | 6503 | 6397 | 6293 | 6191 | 6092 | 16 |
| 17 | 7330 | 7202 | 7077 | 6956 | 6838 | 6723 | 6611 | 6501 | 6395 | 6291 | 6189 | 6090 | 17 |
| 18 | 7328 | 7200 | 7075 | 6954 | 6836 | 6721 | 6609 | 6500 | 6393 | 6289 | 6188 | 6089 | 18 |
| 19 | 7326 | 7198 | 7073 | 6952 | 6834 | 6719 | 6607 | 6498 | 6391 | 6288 | 6186 | 6087 | 19 |
| 20 | 7324 | 7196 | 7071 | 6950 | 6832 | 6717 | 6605 | 6496 | 6390 | 6286 | 6184 | 6085 | 20 |
| 21 | 7322 | 7193 | 7069 | 6948 | 6830 | 6715 | 6603 | 6494 | 6388 | 6284 | 6183 | 6084 | 21 |
| 22 | 7320 | 7191 | 7067 | 6946 | 6828 | 6713 | 6601 | 6492 | 6386 | 6282 | 6181 | 6082 | 22 |
| 23 | 7317 | 7189 | 7065 | 6944 | 6826 | 6711 | 6600 | 6491 | 6384 | 6281 | 6179 | 6080 | 23 |
| 24 | 7315 | 7187 | 7063 | 6942 | 6824 | 6709 | 6598 | 6489 | 6383 | 6279 | 6178 | 6079 | 24 |
| 25 | 7313 | 7185 | 7061 | 6940 | 6822 | 6707 | 6596 | 6487 | 6381 | 6277 | 6176 | 6077 | 25 |
| 26 | 7311 | 7183 | 7059 | 6938 | 6820 | 6706 | 6594 | 6485 | 6379 | 6276 | 6174 | 6076 | 26 |
| 27 | 7309 | 7181 | 7057 | 6936 | 6818 | 6704 | 6592 | 6484 | 6377 | 6274 | 6173 | 6074 | 27 |
| 28 | 7307 | 7179 | 7054 | 6934 | 6816 | 6702 | 6590 | 6482 | 6376 | 6272 | 6171 | 6072 | 28 |
| 29 | 7304 | 7177 | 7052 | 6932 | 6814 | 6700 | 6589 | 6480 | 6374 | 6270 | 6169 | 6071 | 29 |
| 30 | 7302 | 7175 | 7050 | 6930 | 6812 | 6698 | 6587 | 6478 | 6372 | 6269 | 6168 | 6069 | 30 |
| 31 | 7300 | 7172 | 7048 | 6928 | 6810 | 6696 | 6585 | 6476 | 6370 | 6267 | 6166 | 6067 | 31 |
| 32 | 7298 | 7170 | 7046 | 6926 | 6809 | 6694 | 6583 | 6475 | 6369 | 6265 | 6164 | 6066 | 32 |
| 33 | 7296 | 7168 | 7044 | 6924 | 6807 | 6692 | 6581 | 6473 | 6367 | 6264 | 6163 | 6064 | 33 |
| 34 | 7294 | 7166 | 7042 | 6922 | 6805 | 6691 | 6579 | 6471 | 6365 | 6262 | 6161 | 6063 | 34 |
| 35 | 7291 | 7164 | 7040 | 6920 | 6803 | 6689 | 6578 | 6469 | 6363 | 6260 | 6159 | 6061 | 35 |
| 36 | 7289 | 7162 | 7038 | 6918 | 6801 | 6687 | 6576 | 6467 | 6362 | 6259 | 6158 | 6059 | 36 |
| 37 | 7287 | 7160 | 7036 | 6916 | 6799 | 6685 | 6574 | 6466 | 6360 | 6257 | 6156 | 6058 | 37 |
| 38 | 7285 | 7158 | 7034 | 6914 | 6797 | 6683 | 6572 | 6464 | 6358 | 6255 | 6154 | 6056 | 38 |
| 39 | 7283 | 7156 | 7032 | 6912 | 6795 | 6681 | 6570 | 6462 | 6357 | 6254 | 6153 | 6055 | 39 |
| 40 | 7281 | 7154 | 7030 | 6910 | 6793 | 6679 | 6568 | 6460 | 6355 | 6252 | 6151 | 6053 | 40 |
| 41 | 7279 | 7152 | 7028 | 6908 | 6791 | 6677 | 6567 | 6459 | 6353 | 6250 | 6150 | 6051 | 41 |
| 42 | 7276 | 7149 | 7026 | 6906 | 6789 | 6676 | 6565 | 6457 | 6351 | 6248 | 6148 | 6050 | 42 |
| 43 | 7274 | 7147 | 7024 | 6904 | 6787 | 6674 | 6563 | 6455 | 6350 | 6247 | 6146 | 6048 | 43 |
| 44 | 7272 | 7145 | 7022 | 6902 | 6785 | 6672 | 6561 | 6453 | 6348 | 6245 | 6145 | 6046 | 44 |
| 45 | 7270 | 7143 | 7020 | 6900 | 6784 | 6670 | 6559 | 6451 | 6346 | 6243 | 6143 | 6045 | 45 |
| 46 | 7268 | 7141 | 7018 | 6898 | 6782 | 6668 | 6557 | 6450 | 6344 | 6242 | 6141 | 6043 | 46 |
| 47 | 7266 | 7139 | 7016 | 6896 | 6780 | 6666 | 6556 | 6448 | 6343 | 6240 | 6140 | 6042 | 47 |
| 48 | 7264 | 7137 | 7014 | 6894 | 6778 | 6664 | 6554 | 6446 | 6341 | 6238 | 6138 | 6040 | 48 |
| 49 | 7261 | 7135 | 7012 | 6892 | 6776 | 6662 | 6552 | 6444 | 6339 | 6237 | 6136 | 6038 | 49 |
| 50 | 7259 | 7133 | 7010 | 6890 | 6774 | 6661 | 6550 | 6443 | 6338 | 6235 | 6135 | 6037 | 50 |
| 51 | 7257 | 7131 | 7008 | 6888 | 6772 | 6659 | 6548 | 6441 | 6336 | 6233 | 6133 | 6035 | 51 |
| 52 | 7255 | 7129 | 7006 | 6886 | 6770 | 6657 | 6547 | 6439 | 6334 | 6231 | 6131 | 6033 | 52 |
| 53 | 7253 | 7126 | 7004 | 6884 | 6768 | 6655 | 6545 | 6437 | 6332 | 6230 | 6130 | 6032 | 53 |
| 54 | 7251 | 7124 | 7002 | 6882 | 6766 | 6653 | 6543 | 6435 | 6331 | 6228 | 6128 | 6030 | 54 |
| 55 | 7249 | 7122 | 7000 | 6880 | 6764 | 6651 | 6541 | 6434 | 6329 | 6226 | 6126 | 6029 | 55 |
| 56 | 7246 | 7120 | 6998 | 6878 | 6762 | 6649 | 6539 | 6432 | 6327 | 6225 | 6125 | 6027 | 56 |
| 57 | 7244 | 7118 | 6996 | 6877 | 6761 | 6648 | 6538 | 6430 | 6325 | 6223 | 6123 | 6025 | 57 |
| 58 | 7242 | 7116 | 6994 | 6875 | 6759 | 6646 | 6536 | 6428 | 6324 | 6221 | 6121 | 6024 | 58 |
| 59 | 7240 | 7114 | 6992 | 6873 | 6757 | 6644 | 6534 | 6427 | 6322 | 6220 | 6120 | 6022 | 59 |
| 60 | 7238 | 7112 | 6990 | 6871 | 6755 | 6642 | 6532 | 6425 | 6320 | 6218 | 6118 | 6021 | 60 |

## TABLE XXVII.—(*continued*).

### PROPORTIONAL LOGARITHMS

| sec. ″ | h m 0° 45′ | h m 0° 46′ | h m 0° 47′ | h m 0° 48′ | h m 0° 49′ | h m 0° 50′ | h m 0° 51′ | h m 0° 52′ | h m 0° 53′ | h m 0° 54′ | h m 0° 55′ | h m 0° 56′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 6021 | 5925 | 5832 | 5740 | 5651 | 5563 | 5477 | 5393 | 5310 | 5229 | 5149 | 5071 | 0 |
| 1 | 6019 | 5924 | 5830 | 5739 | 5649 | 5562 | 5476 | 5391 | 5309 | 5227 | 5148 | 5070 | 1 |
| 2 | 6017 | 5922 | 5829 | 5737 | 5648 | 5560 | 5474 | 5390 | 5307 | 5226 | 5146 | 5068 | 2 |
| 3 | 6016 | 5920 | 5827 | 5736 | 5646 | 5559 | 5473 | 5389 | 5306 | 5225 | 5145 | 5067 | 3 |
| 4 | 6014 | 5919 | 5826 | 5734 | 5645 | 5557 | 5471 | 5387 | 5304 | 5223 | 5144 | 5066 | 4 |
| 5 | 6013 | 5917 | 5824 | 5733 | 5643 | 5556 | 5470 | 5386 | 5303 | 5222 | 5142 | 5064 | 5 |
| 6 | 6011 | 5916 | 5823 | 5731 | 5642 | 5554 | 5469 | 5384 | 5302 | 5221 | 5141 | 5063 | 6 |
| 7 | 6009 | 5914 | 5821 | 5730 | 5640 | 5553 | 5467 | 5383 | 5300 | 5219 | 5140 | 5062 | 7 |
| 8 | 6008 | 5913 | 5819 | 5728 | 5639 | 5551 | 5466 | 5382 | 5299 | 5218 | 5139 | 5060 | 8 |
| 9 | 6006 | 5911 | 5818 | 5727 | 5637 | 5550 | 5464 | 5380 | 5298 | 5217 | 5137 | 5059 | 9 |
| 10 | 6004 | 5909 | 5816 | 5725 | 5636 | 5549 | 5463 | 5379 | 5296 | 5215 | 5136 | 5058 | 10 |
| 11 | 6003 | 5908 | 5815 | 5724 | 5634 | 5547 | 5461 | 5377 | 5295 | 5214 | 5135 | 5057 | 11 |
| 12 | 6001 | 5906 | 5813 | 5722 | 5633 | 5546 | 5460 | 5376 | 5294 | 5213 | 5133 | 5055 | 12 |
| 13 | 6000 | 5905 | 5812 | 5721 | 5632 | 5544 | 5459 | 5375 | 5292 | 5211 | 5132 | 5054 | 13 |
| 14 | 5998 | 5903 | 5810 | 5719 | 5630 | 5543 | 5457 | 5373 | 5291 | 5210 | 5131 | 5053 | 14 |
| 15 | 5997 | 5902 | 5809 | 5718 | 5629 | 5541 | 5456 | 5372 | 5290 | 5209 | 5129 | 5051 | 15 |
| 16 | 5995 | 5900 | 5807 | 5716 | 5627 | 5540 | 5454 | 5370 | 5288 | 5207 | 5128 | 5050 | 16 |
| 17 | 5993 | 5898 | 5806 | 5715 | 5626 | 5538 | 5453 | 5369 | 5287 | 5206 | 5127 | 5049 | 17 |
| 18 | 5992 | 5897 | 5804 | 5713 | 5624 | 5537 | 5452 | 5368 | 5285 | 5205 | 5125 | 5048 | 18 |
| 19 | 5990 | 5895 | 5803 | 5712 | 5623 | 5536 | 5450 | 5366 | 5284 | 5203 | 5124 | 5046 | 19 |
| 20 | 5988 | 5894 | 5801 | 5710 | 5621 | 5534 | 5449 | 5365 | 5283 | 5202 | 5123 | 5045 | 20 |
| 21 | 5987 | 5892 | 5800 | 5709 | 5620 | 5533 | 5447 | 5364 | 5281 | 5201 | 5122 | 5044 | 21 |
| 22 | 5985 | 5891 | 5798 | 5707 | 5618 | 5531 | 5446 | 5362 | 5280 | 5199 | 5120 | 5042 | 22 |
| 23 | 5984 | 5889 | 5796 | 5706 | 5617 | 5530 | 5444 | 5361 | 5279 | 5198 | 5119 | 5041 | 23 |
| 24 | 5982 | 5888 | 5795 | 5704 | 5615 | 5528 | 5443 | 5359 | 5277 | 5197 | 5118 | 5040 | 24 |
| 25 | 5981 | 5886 | 5793 | 5703 | 5614 | 5527 | 5442 | 5358 | 5276 | 5195 | 5116 | 5039 | 25 |
| 26 | 5979 | 5884 | 5792 | 5701 | 5612 | 5525 | 5440 | 5357 | 5275 | 5194 | 5115 | 5037 | 26 |
| 27 | 5977 | 5883 | 5790 | 5700 | 5611 | 5524 | 5439 | 5355 | 5273 | 5193 | 5114 | 5036 | 27 |
| 28 | 5976 | 5881 | 5789 | 5698 | 5610 | 5523 | 5437 | 5354 | 5272 | 5191 | 5112 | 5035 | 28 |
| 29 | 5974 | 5880 | 5787 | 5697 | 5608 | 5521 | 5436 | 5352 | 5270 | 5190 | 5111 | 5033 | 29 |
| 30 | 5973 | 5878 | 5786 | 5695 | 5607 | 5520 | 5435 | 5351 | 5269 | 5189 | 5110 | 5032 | 30 |
| 31 | 5971 | 5877 | 5784 | 5694 | 5605 | 5518 | 5433 | 5350 | 5268 | 5187 | 5108 | 5031 | 31 |
| 32 | 5969 | 5875 | 5783 | 5692 | 5604 | 5517 | 5432 | 5348 | 5266 | 5186 | 5107 | 5030 | 32 |
| 33 | 5968 | 5874 | 5781 | 5691 | 5602 | 5516 | 5430 | 5347 | 5265 | 5185 | 5106 | 5028 | 33 |
| 34 | 5966 | 5872 | 5780 | 5689 | 5601 | 5514 | 5429 | 5346 | 5264 | 5183 | 5105 | 5027 | 34 |
| 35 | 5965 | 5870 | 5778 | 5688 | 5599 | 5513 | 5428 | 5344 | 5262 | 5182 | 5103 | 5026 | 35 |
| 36 | 5963 | 5869 | 5777 | 5686 | 5598 | 5511 | 5426 | 5343 | 5261 | 5181 | 5102 | 5025 | 36 |
| 37 | 5961 | 5867 | 5775 | 5685 | 5596 | 5510 | 5425 | 5341 | 5260 | 5179 | 5101 | 5023 | 37 |
| 38 | 5960 | 5866 | 5774 | 5683 | 5595 | 5508 | 5423 | 5340 | 5258 | 5178 | 5099 | 5022 | 38 |
| 39 | 5958 | 5864 | 5772 | 5682 | 5594 | 5507 | 5422 | 5339 | 5257 | 5177 | 5098 | 5021 | 39 |
| 40 | 5957 | 5863 | 5771 | 5680 | 5592 | 5505 | 5421 | 5337 | 5256 | 5175 | 5097 | 5019 | 40 |
| 41 | 5955 | 5861 | 5769 | 5679 | 5591 | 5504 | 5419 | 5336 | 5254 | 5174 | 5095 | 5018 | 41 |
| 42 | 5954 | 5860 | 5768 | 5677 | 5589 | 5503 | 5418 | 5335 | 5253 | 5173 | 5094 | 5017 | 42 |
| 43 | 5952 | 5858 | 5766 | 5676 | 5588 | 5501 | 5416 | 5333 | 5252 | 5171 | 5093 | 5016 | 43 |
| 44 | 5950 | 5856 | 5764 | 5674 | 5586 | 5500 | 5415 | 5332 | 5250 | 5170 | 5092 | 5014 | 44 |
| 45 | 5949 | 5855 | 5763 | 5673 | 5585 | 5498 | 5414 | 5331 | 5249 | 5169 | 5090 | 5013 | 45 |
| 46 | 5947 | 5853 | 5761 | 5671 | 5583 | 5497 | 5412 | 5329 | 5248 | 5168 | 5089 | 5012 | 46 |
| 47 | 5946 | 5852 | 5760 | 5670 | 5582 | 5495 | 5411 | 5328 | 5246 | 5166 | 5088 | 5010 | 47 |
| 48 | 5944 | 5850 | 5758 | 5669 | 5580 | 5494 | 5409 | 5326 | 5245 | 5165 | 5086 | 5009 | 48 |
| 49 | 5942 | 5849 | 5757 | 5667 | 5579 | 5493 | 5408 | 5325 | 5244 | 5164 | 5085 | 5008 | 49 |
| 50 | 5941 | 5847 | 5755 | 5666 | 5577 | 5491 | 5407 | 5324 | 5242 | 5162 | 5084 | 5007 | 50 |
| 51 | 5939 | 5846 | 5754 | 5664 | 5576 | 5490 | 5405 | 5322 | 5241 | 5161 | 5082 | 5005 | 51 |
| 52 | 5938 | 5844 | 5752 | 5663 | 5575 | 5488 | 5404 | 5321 | 5239 | 5160 | 5081 | 5004 | 52 |
| 53 | 5936 | 5842 | 5751 | 5661 | 5573 | 5487 | 5402 | 5319 | 5238 | 5158 | 5080 | 5003 | 53 |
| 54 | 5935 | 5841 | 5749 | 5660 | 5572 | 5486 | 5401 | 5318 | 5237 | 5157 | 5079 | 5002 | 54 |
| 55 | 5933 | 5839 | 5748 | 5658 | 5570 | 5484 | 5400 | 5317 | 5235 | 5156 | 5077 | 5000 | 55 |
| 56 | 5931 | 5838 | 5746 | 5657 | 5569 | 5483 | 5398 | 5315 | 5234 | 5154 | 5076 | 4999 | 56 |
| 57 | 5930 | 5836 | 5745 | 5655 | 5567 | 5481 | 5397 | 5314 | 5233 | 5153 | 5075 | 4998 | 57 |
| 58 | 5928 | 5835 | 5743 | 5654 | 5566 | 5480 | 5395 | 5313 | 5231 | 5152 | 5073 | 4996 | 58 |
| 59 | 5927 | 5833 | 5742 | 5652 | 5564 | 5478 | 5394 | 5311 | 5230 | 5150 | 5072 | 4995 | 59 |
| 60 | 5925 | 5832 | 5740 | 5651 | 5563 | 5477 | 5393 | 5310 | 5229 | 5149 | 5071 | 4994 | 60 |

## TABLE XXVII.—(*continued*).

### PROPORTIONAL LOGARITHMS

| sec. ″ | h m 0° 57′ | h m 0° 58′ | h m 0° 59′ | h m 1° 0′ | h m 1° 1′ | h m 1° 2′ | h m 1° 3′ | h m 1° 4′ | h m 1° 5′ | h m 1° 6′ | h m 1° 7′ | h m 1° 8′ | h m 1° 9′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 4994 | 4918 | 4844 | 4771 | 4699 | 4629 | 4559 | 4491 | 4424 | 4357 | 4292 | 4228 | 4164 | 0 |
| 1 | 4993 | 4917 | 4843 | 4770 | 4698 | 4628 | 4558 | 4490 | 4422 | 4356 | 4291 | 4227 | 4163 | 1 |
| 2 | 4991 | 4916 | 4842 | 4769 | 4697 | 4626 | 4557 | 4489 | 4421 | 4355 | 4290 | 4225 | 4162 | 2 |
| 3 | 4990 | 4915 | 4841 | 4768 | 4696 | 4625 | 4556 | 4488 | 4420 | 4354 | 4289 | 4224 | 4161 | 3 |
| 4 | 4989 | 4913 | 4839 | 4766 | 4694 | 4624 | 4555 | 4486 | 4419 | 4353 | 4288 | 4223 | 4160 | 4 |
| 5 | 4988 | 4912 | 4838 | 4765 | 4693 | 4623 | 4554 | 4485 | 4418 | 4352 | 4287 | 4222 | 4159 | 5 |
| 6 | 4986 | 4911 | 4837 | 4764 | 4692 | 4622 | 4552 | 4484 | 4417 | 4351 | 4285 | 4221 | 4158 | 6 |
| 7 | 4985 | 4910 | 4836 | 4763 | 4691 | 4621 | 4551 | 4483 | 4416 | 4350 | 4284 | 4220 | 4157 | 7 |
| 8 | 4984 | 4908 | 4834 | 4762 | 4690 | 4619 | 4550 | 4482 | 4415 | 4348 | 4283 | 4219 | 4156 | 8 |
| 9 | 4983 | 4907 | 4833 | 4760 | 4689 | 4618 | 4549 | 4481 | 4414 | 4347 | 4282 | 4218 | 4155 | 9 |
| 10 | 4981 | 4906 | 4832 | 4759 | 4688 | 4617 | 4548 | 4480 | 4412 | 4346 | 4281 | 4217 | 4154 | 10 |
| 11 | 4980 | 4905 | 4831 | 4758 | 4686 | 4616 | 4547 | 4478 | 4411 | 4345 | 4280 | 4216 | 4153 | 11 |
| 12 | 4979 | 4903 | 4830 | 4757 | 4685 | 4615 | 4546 | 4477 | 4410 | 4344 | 4279 | 4215 | 4152 | 12 |
| 13 | 4977 | 4902 | 4828 | 4756 | 4684 | 4614 | 4544 | 4476 | 4409 | 4343 | 4278 | 4214 | 4151 | 13 |
| 14 | 4976 | 4901 | 4827 | 4754 | 4683 | 4612 | 4543 | 4475 | 4408 | 4342 | 4277 | 4213 | 4150 | 14 |
| 15 | 4975 | 4900 | 4826 | 4753 | 4682 | 4611 | 4542 | 4474 | 4407 | 4341 | 4276 | 4212 | 4149 | 15 |
| 16 | 4974 | 4898 | 4825 | 4752 | 4680 | 4610 | 4541 | 4473 | 4406 | 4340 | 4275 | 4211 | 4147 | 16 |
| 17 | 4972 | 4897 | 4823 | 4751 | 4679 | 4609 | 4540 | 4472 | 4405 | 4339 | 4274 | 4210 | 4146 | 17 |
| 18 | 4971 | 4896 | 4822 | 4750 | 4678 | 4608 | 4539 | 4471 | 4404 | 4338 | 4273 | 4209 | 4145 | 18 |
| 19 | 4970 | 4895 | 4821 | 4748 | 4677 | 4607 | 4537 | 4469 | 4402 | 4336 | 4271 | 4207 | 4144 | 19 |
| 20 | 4969 | 4894 | 4820 | 4747 | 4676 | 4605 | 4536 | 4468 | 4401 | 4335 | 4270 | 4206 | 4143 | 20 |
| 21 | 4967 | 4892 | 4819 | 4746 | 4675 | 4604 | 4535 | 4467 | 4400 | 4334 | 4269 | 4205 | 4142 | 21 |
| 22 | 4966 | 4891 | 4817 | 4745 | 4673 | 4603 | 4534 | 4466 | 4399 | 4333 | 4268 | 4204 | 4141 | 22 |
| 23 | 4965 | 4890 | 4816 | 4744 | 4672 | 4602 | 4533 | 4465 | 4398 | 4332 | 4267 | 4203 | 4140 | 23 |
| 24 | 4964 | 4889 | 4815 | 4742 | 4671 | 4601 | 4532 | 4464 | 4397 | 4331 | 4266 | 4202 | 4139 | 24 |
| 25 | 4962 | 4887 | 4814 | 4741 | 4670 | 4600 | 4531 | 4463 | 4396 | 4330 | 4265 | 4201 | 4138 | 25 |
| 26 | 4961 | 4886 | 4812 | 4740 | 4669 | 4599 | 4529 | 4462 | 4395 | 4329 | 4264 | 4200 | 4137 | 26 |
| 27 | 4960 | 4885 | 4811 | 4739 | 4668 | 4597 | 4528 | 4460 | 4394 | 4328 | 4263 | 4199 | 4136 | 27 |
| 28 | 4959 | 4884 | 4810 | 4738 | 4666 | 4596 | 4527 | 4459 | 4392 | 4327 | 4262 | 4198 | 4135 | 28 |
| 29 | 4957 | 4882 | 4809 | 4736 | 4665 | 4595 | 4526 | 4458 | 4391 | 4326 | 4261 | 4197 | 4134 | 29 |
| 30 | 4956 | 4881 | 4808 | 4735 | 4664 | 4594 | 4525 | 4457 | 4390 | 4325 | 4260 | 4196 | 4133 | 30 |
| 31 | 4955 | 4880 | 4806 | 4734 | 4663 | 4593 | 4524 | 4456 | 4389 | 4323 | 4259 | 4195 | 4132 | 31 |
| 32 | 4953 | 4879 | 4805 | 4733 | 4662 | 4592 | 4523 | 4455 | 4388 | 4322 | 4257 | 4194 | 4131 | 32 |
| 33 | 4952 | 4877 | 4804 | 4732 | 4660 | 4590 | 4522 | 4454 | 4387 | 4321 | 4256 | 4193 | 4130 | 33 |
| 34 | 4951 | 4876 | 4803 | 4730 | 4659 | 4589 | 4520 | 4453 | 4386 | 4320 | 4255 | 4192 | 4129 | 34 |
| 35 | 4950 | 4875 | 4801 | 4729 | 4658 | 4588 | 4519 | 4451 | 4385 | 4319 | 4254 | 4190 | 4128 | 35 |
| 36 | 4949 | 4874 | 4800 | 4728 | 4657 | 4587 | 4518 | 4450 | 4384 | 4318 | 4253 | 4189 | 4127 | 36 |
| 37 | 4947 | 4872 | 4799 | 4727 | 4656 | 4586 | 4517 | 4449 | 4383 | 4317 | 4252 | 4188 | 4126 | 37 |
| 38 | 4946 | 4871 | 4798 | 4726 | 4655 | 4585 | 4516 | 4448 | 4381 | 4316 | 4251 | 4187 | 4125 | 38 |
| 39 | 4945 | 4870 | 4797 | 4724 | 4653 | 4584 | 4515 | 4447 | 4380 | 4315 | 4250 | 4186 | 4124 | 39 |
| 40 | 4943 | 4869 | 4795 | 4723 | 4652 | 4582 | 4514 | 4446 | 4379 | 4314 | 4249 | 4185 | 4122 | 40 |
| 41 | 4942 | 4868 | 4794 | 4722 | 4651 | 4581 | 4512 | 4445 | 4378 | 4313 | 4248 | 4184 | 4121 | 41 |
| 42 | 4941 | 4866 | 4793 | 4721 | 4650 | 4580 | 4511 | 4444 | 4377 | 4311 | 4247 | 4183 | 4120 | 42 |
| 43 | 4940 | 4865 | 4792 | 4720 | 4649 | 4579 | 4510 | 4443 | 4376 | 4310 | 4246 | 4182 | 4119 | 43 |
| 44 | 4938 | 4864 | 4791 | 4718 | 4647 | 4578 | 4509 | 4441 | 4375 | 4309 | 4245 | 4181 | 4118 | 44 |
| 45 | 4937 | 4863 | 4789 | 4717 | 4646 | 4577 | 4508 | 4440 | 4374 | 4308 | 4244 | 4180 | 4117 | 45 |
| 46 | 4936 | 4861 | 4788 | 4716 | 4645 | 4575 | 4507 | 4439 | 4373 | 4307 | 4243 | 4179 | 4116 | 46 |
| 47 | 4935 | 4860 | 4787 | 4715 | 4644 | 4574 | 4506 | 4438 | 4372 | 4306 | 4241 | 4178 | 4115 | 47 |
| 48 | 4933 | 4859 | 4786 | 4714 | 4643 | 4573 | 4505 | 4437 | 4370 | 4305 | 4240 | 4177 | 4114 | 48 |
| 49 | 4932 | 4858 | 4784 | 4712 | 4642 | 4572 | 4503 | 4436 | 4369 | 4304 | 4239 | 4176 | 4113 | 49 |
| 50 | 4931 | 4856 | 4783 | 4711 | 4640 | 4571 | 4502 | 4435 | 4368 | 4303 | 4238 | 4175 | 4112 | 50 |
| 51 | 4930 | 4855 | 4782 | 4710 | 4639 | 4570 | 4501 | 4434 | 4367 | 4302 | 4237 | 4174 | 4111 | 51 |
| 52 | 4928 | 4854 | 4781 | 4709 | 4638 | 4568 | 4500 | 4432 | 4366 | 4301 | 4236 | 4173 | 4110 | 52 |
| 53 | 4927 | 4853 | 4780 | 4708 | 4637 | 4567 | 4499 | 4431 | 4365 | 4299 | 4235 | 4172 | 4109 | 53 |
| 54 | 4926 | 4852 | 4778 | 4707 | 4636 | 4566 | 4498 | 4430 | 4364 | 4298 | 4234 | 4171 | 4108 | 54 |
| 55 | 4925 | 4850 | 4777 | 4705 | 4635 | 4565 | 4497 | 4429 | 4363 | 4297 | 4233 | 4169 | 4107 | 55 |
| 56 | 4923 | 4849 | 4776 | 4704 | 4633 | 4564 | 4495 | 4428 | 4362 | 4296 | 4232 | 4168 | 4106 | 56 |
| 57 | 4922 | 4848 | 4775 | 4703 | 4632 | 4563 | 4494 | 4427 | 4361 | 4295 | 4231 | 4167 | 4105 | 57 |
| 58 | 4921 | 4846 | 4774 | 4702 | 4631 | 4562 | 4493 | 4426 | 4359 | 4294 | 4230 | 4166 | 4104 | 58 |
| 59 | 4920 | 4845 | 4772 | 4701 | 4630 | 4560 | 4492 | 4425 | 4358 | 4293 | 4229 | 4165 | 4103 | 59 |
| 60 | 4918 | 4844 | 4771 | 4699 | 4629 | 4559 | 4491 | 4424 | 4357 | 4292 | 4228 | 4164 | 4102 | 60 |

TABLE XXVII.—(*continued*).

## PROPORTIONAL LOGARITHMS

| sec. ″ | h m 1° 10′ | h m 1° 11′ | h m 1° 12′ | h m 1° 13′ | h m 1° 14′ | h m 1° 15′ | h m 1° 16′ | h m 1° 17′ | h m 1° 18′ | h m 1° 19′ | h m 1° 20′ | h m 1° 21′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 4102 | 4040 | 3979 | 3919 | 3860 | 3802 | 3745 | 3688 | 3632 | 3576 | 3522 | 3468 | 0 |
| 1 | 4101 | 4039 | 3978 | 3918 | 3859 | 3801 | 3744 | 3687 | 3631 | 3575 | 3521 | 3467 | 1 |
| 2 | 4100 | 4038 | 3977 | 3917 | 3858 | 3800 | 3743 | 3686 | 3630 | 3575 | 3520 | 3466 | 2 |
| 3 | 4099 | 4037 | 3976 | 3917 | 3857 | 3799 | 3742 | 3685 | 3629 | 3574 | 3519 | 3465 | 3 |
| 4 | 4098 | 4036 | 3975 | 3916 | 3856 | 3798 | 3741 | 3684 | 3628 | 3573 | 3518 | 3464 | 4 |
| 5 | 4097 | 4035 | 3974 | 3915 | 3855 | 3797 | 3740 | 3683 | 3627 | 3572 | 3517 | 3463 | 5 |
| 6 | 4096 | 4034 | 3973 | 3914 | 3855 | 3796 | 3739 | 3682 | 3626 | 3571 | 3516 | 3463 | 6 |
| 7 | 4094 | 4033 | 3972 | 3913 | 3854 | 3795 | 3738 | 3681 | 3625 | 3570 | 3515 | 3462 | 7 |
| 8 | 4093 | 4032 | 3971 | 3912 | 3853 | 3794 | 3737 | 3680 | 3624 | 3569 | 3515 | 3461 | 8 |
| 9 | 4092 | 4031 | 3970 | 3911 | 3852 | 3793 | 3736 | 3679 | 3623 | 3568 | 3514 | 3460 | 9 |
| 10 | 4091 | 4030 | 3969 | 3910 | 3851 | 3792 | 3735 | 3678 | 3622 | 3567 | 3513 | 3459 | 10 |
| 11 | 4090 | 4029 | 3968 | 3909 | 3850 | 3791 | 3734 | 3677 | 3622 | 3566 | 3512 | 3458 | 11 |
| 12 | 4089 | 4028 | 3967 | 3908 | 3849 | 3791 | 3733 | 3677 | 3621 | 3565 | 3511 | 3457 | 12 |
| 13 | 4088 | 4027 | 3966 | 3907 | 3848 | 3790 | 3732 | 3676 | 3620 | 3565 | 3510 | 3456 | 13 |
| 14 | 4087 | 4026 | 3965 | 3906 | 3847 | 3789 | 3731 | 3675 | 3619 | 3564 | 3509 | 3455 | 14 |
| 15 | 4086 | 4025 | 3964 | 3905 | 3846 | 3788 | 3730 | 3674 | 3618 | 3563 | 3508 | 3454 | 15 |
| 16 | 4085 | 4024 | 3963 | 3904 | 3845 | 3787 | 3729 | 3673 | 3617 | 3562 | 3507 | 3454 | 16 |
| 17 | 4084 | 4023 | 3962 | 3903 | 3844 | 3786 | 3728 | 3672 | 3616 | 3561 | 3506 | 3453 | 17 |
| 18 | 4083 | 4022 | 3961 | 3902 | 3843 | 3785 | 3727 | 3671 | 3615 | 3560 | 3506 | 3452 | 18 |
| 19 | 4082 | 4021 | 3960 | 3901 | 3842 | 3784 | 3726 | 3670 | 3614 | 3559 | 3505 | 3451 | 19 |
| 20 | 4081 | 4020 | 3959 | 3900 | 3841 | 3783 | 3726 | 3669 | 3613 | 3558 | 3504 | 3450 | 20 |
| 21 | 4080 | 4019 | 3958 | 3899 | 3840 | 3782 | 3725 | 3668 | 3612 | 3557 | 3503 | 3449 | 21 |
| 22 | 4079 | 4018 | 3957 | 3898 | 3839 | 3781 | 3724 | 3667 | 3611 | 3556 | 3502 | 3448 | 22 |
| 23 | 4078 | 4017 | 3956 | 3897 | 3838 | 3780 | 3723 | 3666 | 3610 | 3555 | 3501 | 3447 | 23 |
| 24 | 4077 | 4016 | 3955 | 3896 | 3837 | 3779 | 3722 | 3665 | 3610 | 3555 | 3500 | 3446 | 24 |
| 25 | 4076 | 4015 | 3954 | 3895 | 3836 | 3778 | 3721 | 3664 | 3609 | 3554 | 3499 | 3446 | 25 |
| 26 | 4075 | 4014 | 3953 | 3894 | 3835 | 3777 | 3720 | 3663 | 3608 | 3553 | 3498 | 3445 | 26 |
| 27 | 4074 | 4013 | 3952 | 3893 | 3834 | 3776 | 3719 | 3663 | 3607 | 3552 | 3497 | 3444 | 27 |
| 28 | 4073 | 4012 | 3951 | 3892 | 3833 | 3775 | 3718 | 3662 | 3606 | 3551 | 3496 | 3443 | 28 |
| 29 | 4072 | 4011 | 3950 | 3891 | 3832 | 3774 | 3717 | 3661 | 3605 | 3550 | 3496 | 3442 | 29 |
| 30 | 4071 | 4010 | 3949 | 3890 | 3831 | 3773 | 3716 | 3660 | 3604 | 3549 | 3495 | 3441 | 30 |
| 31 | 4070 | 4009 | 3948 | 3889 | 3830 | 3772 | 3715 | 3659 | 3603 | 3548 | 3494 | 3440 | 31 |
| 32 | 4069 | 4008 | 3947 | 3888 | 3829 | 3771 | 3714 | 3658 | 3602 | 3547 | 3493 | 3439 | 32 |
| 33 | 4068 | 4007 | 3946 | 3887 | 3828 | 3770 | 3713 | 3657 | 3601 | 3546 | 3492 | 3438 | 33 |
| 34 | 4067 | 4006 | 3945 | 3886 | 3827 | 3769 | 3712 | 3656 | 3600 | 3545 | 3491 | 3438 | 34 |
| 35 | 4066 | 4005 | 3944 | 3885 | 3826 | 3768 | 3711 | 3655 | 3599 | 3544 | 3490 | 3437 | 35 |
| 36 | 4065 | 4004 | 3943 | 3884 | 3825 | 3768 | 3710 | 3654 | 3598 | 3544 | 3489 | 3436 | 36 |
| 37 | 4064 | 4003 | 3942 | 3883 | 3824 | 3767 | 3709 | 3653 | 3598 | 3543 | 3488 | 3435 | 37 |
| 38 | 4063 | 4002 | 3941 | 3882 | 3823 | 3766 | 3708 | 3652 | 3597 | 3542 | 3488 | 3434 | 38 |
| 39 | 4062 | 4001 | 3940 | 3881 | 3822 | 3765 | 3708 | 3651 | 3596 | 3541 | 3487 | 3433 | 39 |
| 40 | 4061 | 4000 | 3939 | 3880 | 3821 | 3764 | 3707 | 3650 | 3595 | 3540 | 3486 | 3432 | 40 |
| 41 | 4060 | 3999 | 3938 | 3879 | 3820 | 3763 | 3706 | 3649 | 3594 | 3539 | 3485 | 3431 | 41 |
| 42 | 4059 | 3998 | 3937 | 3878 | 3820 | 3762 | 3705 | 3649 | 3593 | 3538 | 3484 | 3431 | 42 |
| 43 | 4057 | 3997 | 3936 | 3877 | 3819 | 3761 | 3704 | 3648 | 3592 | 3537 | 3483 | 3430 | 43 |
| 44 | 4056 | 3996 | 3935 | 3876 | 3818 | 3760 | 3703 | 3647 | 3591 | 3536 | 3482 | 3429 | 44 |
| 45 | 4055 | 3995 | 3934 | 3875 | 3817 | 3759 | 3702 | 3646 | 3590 | 3535 | 3481 | 3428 | 45 |
| 46 | 4054 | 3993 | 3933 | 3874 | 3816 | 3758 | 3701 | 3645 | 3589 | 3534 | 3480 | 3427 | 46 |
| 47 | 4053 | 3992 | 3932 | 3873 | 3815 | 3757 | 3700 | 3644 | 3588 | 3533 | 3479 | 3426 | 47 |
| 48 | 4052 | 3991 | 3931 | 3872 | 3814 | 3756 | 3699 | 3643 | 3587 | 3533 | 3479 | 3425 | 48 |
| 49 | 4051 | 3990 | 3930 | 3871 | 3813 | 3755 | 3698 | 3642 | 3586 | 3532 | 3478 | 3424 | 49 |
| 50 | 4050 | 3989 | 3929 | 3870 | 3812 | 3754 | 3697 | 3641 | 3586 | 3531 | 3477 | 3423 | 50 |
| 51 | 4049 | 3988 | 3928 | 3869 | 3811 | 3753 | 3696 | 3640 | 3585 | 3530 | 3476 | 3423 | 51 |
| 52 | 4048 | 3987 | 3927 | 3868 | 3810 | 3752 | 3695 | 3639 | 3584 | 3529 | 3475 | 3422 | 52 |
| 53 | 4047 | 3986 | 3926 | 3867 | 3809 | 3751 | 3694 | 3638 | 3583 | 3528 | 3474 | 3421 | 53 |
| 54 | 4046 | 3985 | 3925 | 3866 | 3808 | 3750 | 3693 | 3637 | 3582 | 3527 | 3473 | 3420 | 54 |
| 55 | 4045 | 3984 | 3924 | 3865 | 3807 | 3749 | 3692 | 3636 | 3581 | 3526 | 3472 | 3419 | 55 |
| 56 | 4044 | 3983 | 3923 | 3864 | 3806 | 3748 | 3692 | 3635 | 3580 | 3525 | 3471 | 3418 | 56 |
| 57 | 4043 | 3982 | 3922 | 3863 | 3805 | 3747 | 3691 | 3635 | 3579 | 3525 | 3471 | 3417 | 57 |
| 58 | 4042 | 3981 | 3921 | 3862 | 3804 | 3746 | 3690 | 3634 | 3578 | 3524 | 3470 | 3416 | 58 |
| 59 | 4041 | 3980 | 3920 | 3861 | 3803 | 3745 | 3689 | 3633 | 3577 | 3523 | 3469 | 3415 | 59 |
| 60 | 4040 | 3979 | 3919 | 3860 | 3802 | 3745 | 3688 | 3632 | 3576 | 3522 | 3468 | 3415 | 60 |

## TABLE XXVII.—(*continued*).

### PROPORTIONAL LOGARITHMS

| sec. ″ | h m 1° 22′ | h m 1° 23′ | h m 1° 24′ | h m 1° 25′ | h m 1° 26′ | h m 1° 27′ | h m 1° 28′ | h m 1° 29′ | h m 1° 30′ | h m 1° 31′ | h m 1° 32′ | h m 1° 33′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 3415 | 3362 | 3310 | 3259 | 3208 | 3158 | 3108 | 3059 | 3010 | 2962 | 2915 | 2868 | 0 |
| 1 | 3414 | 3361 | 3309 | 3258 | 3207 | 3157 | 3107 | 3058 | 3009 | 2961 | 2914 | 2867 | 1 |
| 2 | 3413 | 3360 | 3308 | 3257 | 3206 | 3156 | 3106 | 3057 | 3009 | 2961 | 2913 | 2866 | 2 |
| 3 | 3412 | 3359 | 3307 | 3256 | 3205 | 3155 | 3105 | 3056 | 3008 | 2960 | 2912 | 2866 | 3 |
| 4 | 3411 | 3358 | 3306 | 3255 | 3204 | 3154 | 3105 | 3056 | 3007 | 2959 | 2912 | 2865 | 4 |
| 5 | 3410 | 3358 | 3306 | 3254 | 3203 | 3153 | 3104 | 3055 | 3006 | 2958 | 2911 | 2864 | 5 |
| 6 | 3409 | 3357 | 3305 | 3253 | 3203 | 3153 | 3103 | 3054 | 3005 | 2958 | 2910 | 2863 | 6 |
| 7 | 3408 | 3356 | 3304 | 3253 | 3202 | 3152 | 3102 | 3053 | 3005 | 2957 | 2909 | 2862 | 7 |
| 8 | 3407 | 3355 | 3303 | 3252 | 3201 | 3151 | 3101 | 3052 | 3004 | 2956 | 2909 | 2862 | 8 |
| 9 | 3407 | 3354 | 3302 | 3251 | 3200 | 3150 | 3101 | 3052 | 3003 | 2955 | 2908 | 2861 | 9 |
| 10 | 3406 | 3353 | 3301 | 3250 | 3199 | 3149 | 3100 | 3051 | 3002 | 2954 | 2907 | 2860 | 10 |
| 11 | 3405 | 3352 | 3300 | 3249 | 3198 | 3148 | 3099 | 3050 | 3001 | 2954 | 2906 | 2859 | 11 |
| 12 | 3404 | 3351 | 3300 | 3248 | 3198 | 3148 | 3098 | 3049 | 3001 | 2953 | 2905 | 2859 | 12 |
| 13 | 3403 | 3351 | 3299 | 3247 | 3197 | 3147 | 3097 | 3048 | 3000 | 2952 | 2905 | 2858 | 13 |
| 14 | 3402 | 3350 | 3298 | 3247 | 3196 | 3146 | 3097 | 3047 | 2999 | 2951 | 2904 | 2857 | 14 |
| 15 | 3401 | 3349 | 3297 | 3246 | 3195 | 3145 | 3096 | 3047 | 2998 | 2950 | 2903 | 2856 | 15 |
| 16 | 3400 | 3348 | 3296 | 3245 | 3194 | 3144 | 3095 | 3046 | 2997 | 2950 | 2902 | 2855 | 16 |
| 17 | 3400 | 3347 | 3295 | 3244 | 3193 | 3143 | 3094 | 3045 | 2997 | 2949 | 2901 | 2855 | 17 |
| 18 | 3399 | 3346 | 3294 | 3243 | 3193 | 3143 | 3093 | 3044 | 2996 | 2948 | 2901 | 2854 | 18 |
| 19 | 3398 | 3345 | 3294 | 3242 | 3192 | 3142 | 3092 | 3043 | 2995 | 2947 | 2900 | 2853 | 19 |
| 20 | 3397 | 3344 | 3293 | 3241 | 3191 | 3141 | 3091 | 3043 | 2994 | 2946 | 2899 | 2852 | 20 |
| 21 | 3396 | 3344 | 3292 | 3241 | 3190 | 3140 | 3091 | 3042 | 2993 | 2946 | 2898 | 2852 | 21 |
| 22 | 3395 | 3343 | 3291 | 3240 | 3189 | 3139 | 3090 | 3041 | 2993 | 2945 | 2898 | 2851 | 22 |
| 23 | 3394 | 3342 | 3290 | 3239 | 3188 | 3138 | 3089 | 3040 | 2992 | 2944 | 2897 | 2850 | 23 |
| 24 | 3393 | 3341 | 3289 | 3238 | 3188 | 3138 | 3088 | 3039 | 2991 | 2943 | 2896 | 2849 | 24 |
| 25 | 3393 | 3340 | 3288 | 3237 | 3187 | 3137 | 3087 | 3038 | 2990 | 2942 | 2895 | 2848 | 25 |
| 26 | 3392 | 3339 | 3288 | 3236 | 3186 | 3136 | 3087 | 3038 | 2989 | 2942 | 2894 | 2848 | 26 |
| 27 | 3391 | 3338 | 3287 | 3236 | 3185 | 3135 | 3086 | 3037 | 2989 | 2941 | 2894 | 2847 | 27 |
| 28 | 3390 | 3338 | 3286 | 3235 | 3184 | 3134 | 3085 | 3036 | 2988 | 2940 | 2893 | 2846 | 28 |
| 29 | 3389 | 3337 | 3285 | 3234 | 3183 | 3133 | 3084 | 3035 | 2987 | 2939 | 2892 | 2845 | 29 |
| 30 | 3388 | 3336 | 3284 | 3233 | 3183 | 3133 | 3083 | 3034 | 2986 | 2939 | 2891 | 2845 | 30 |
| 31 | 3387 | 3335 | 3283 | 3232 | 3182 | 3132 | 3082 | 3034 | 2985 | 2938 | 2890 | 2844 | 31 |
| 32 | 3386 | 3334 | 3282 | 3231 | 3181 | 3131 | 3082 | 3033 | 2985 | 2937 | 2890 | 2843 | 32 |
| 33 | 3386 | 3333 | 3282 | 3231 | 3180 | 3130 | 3081 | 3032 | 2984 | 2936 | 2889 | 2842 | 33 |
| 34 | 3385 | 3332 | 3281 | 3230 | 3179 | 3129 | 3080 | 3031 | 2983 | 2935 | 2888 | 2841 | 34 |
| 35 | 3384 | 3331 | 3280 | 3229 | 3178 | 3128 | 3079 | 3030 | 2982 | 2935 | 2887 | 2841 | 35 |
| 36 | 3383 | 3331 | 3279 | 3228 | 3178 | 3128 | 3078 | 3030 | 2981 | 2934 | 2887 | 2840 | 36 |
| 37 | 3382 | 3330 | 3278 | 3227 | 3177 | 3127 | 3078 | 3029 | 2981 | 2933 | 2886 | 2839 | 37 |
| 38 | 3381 | 3329 | 3277 | 3226 | 3176 | 3126 | 3077 | 3028 | 2980 | 2932 | 2885 | 2838 | 38 |
| 39 | 3380 | 3328 | 3276 | 3225 | 3175 | 3125 | 3076 | 3027 | 2979 | 2931 | 2884 | 2838 | 39 |
| 40 | 3379 | 3327 | 3276 | 3225 | 3174 | 3124 | 3075 | 3026 | 2978 | 2931 | 2883 | 2837 | 40 |
| 41 | 3378 | 3326 | 3275 | 3224 | 3173 | 3124 | 3074 | 3026 | 2977 | 2930 | 2883 | 2836 | 41 |
| 42 | 3378 | 3325 | 3274 | 3223 | 3173 | 3123 | 3073 | 3025 | 2977 | 2929 | 2882 | 2835 | 42 |
| 43 | 3377 | 3325 | 3273 | 3222 | 3172 | 3122 | 3073 | 3024 | 2976 | 2928 | 2881 | 2835 | 43 |
| 44 | 3376 | 3324 | 3272 | 3221 | 3171 | 3121 | 3072 | 3023 | 2975 | 2927 | 2880 | 2834 | 44 |
| 45 | 3375 | 3323 | 3271 | 3220 | 3170 | 3120 | 3071 | 3022 | 2974 | 2927 | 2880 | 2833 | 45 |
| 46 | 3374 | 3322 | 3270 | 3219 | 3169 | 3119 | 3070 | 3022 | 2973 | 2926 | 2879 | 2832 | 46 |
| 47 | 3373 | 3321 | 3270 | 3219 | 3168 | 3119 | 3069 | 3021 | 2973 | 2925 | 2878 | 2831 | 47 |
| 48 | 3372 | 3320 | 3269 | 3218 | 3168 | 3118 | 3069 | 3020 | 2972 | 2924 | 2877 | 2831 | 48 |
| 49 | 3371 | 3319 | 3268 | 3217 | 3167 | 3117 | 3068 | 3019 | 2971 | 2923 | 2876 | 2830 | 49 |
| 50 | 3371 | 3319 | 3267 | 3216 | 3166 | 3116 | 3067 | 3018 | 2970 | 2923 | 2876 | 2829 | 50 |
| 51 | 3370 | 3318 | 3266 | 3215 | 3165 | 3115 | 3066 | 3018 | 2969 | 2922 | 2875 | 2828 | 51 |
| 52 | 3369 | 3317 | 3265 | 3214 | 3164 | 3114 | 3065 | 3017 | 2969 | 2921 | 2874 | 2828 | 52 |
| 53 | 3368 | 3316 | 3264 | 3214 | 3163 | 3114 | 3064 | 3016 | 2968 | 2920 | 2873 | 2827 | 53 |
| 54 | 3367 | 3315 | 3264 | 3213 | 3163 | 3113 | 3064 | 3015 | 2967 | 2920 | 2873 | 2826 | 54 |
| 55 | 3366 | 3314 | 3263 | 3212 | 3162 | 3112 | 3063 | 3014 | 2966 | 2919 | 2872 | 2825 | 55 |
| 56 | 3365 | 3313 | 3262 | 3211 | 3161 | 3111 | 3062 | 3013 | 2965 | 2918 | 2871 | 2824 | 56 |
| 57 | 3365 | 3313 | 3261 | 3210 | 3160 | 3110 | 3061 | 3013 | 2965 | 2917 | 2870 | 2824 | 57 |
| 58 | 3364 | 3312 | 3260 | 3209 | 3159 | 3109 | 3060 | 3012 | 2964 | 2916 | 2869 | 2823 | 58 |
| 59 | 3363 | 3311 | 3259 | 3209 | 3158 | 3109 | 3060 | 3011 | 2963 | 2916 | 2869 | 2822 | 59 |
| 60 | 3362 | 3310 | 3259 | 3208 | 3158 | 3108 | 3059 | 3010 | 2962 | 2915 | 2868 | 2821 | 60 |

TABLE XXVII.—(*continued*).

PROPORTIONAL LOGARITHMS

| sec. ″ | h m 1° 34′ | h m 1° 35′ | h m 1° 36′ | h m 1° 37′ | h m 1° 38′ | h m 1° 39′ | h m 1° 40′ | h m 1° 41′ | h m 1° 42′ | h m 1° 43′ | h m 1° 44′ | h m 1° 45′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2821 | 2775 | 2730 | 2685 | 2640 | 2596 | 2553 | 2510 | 2467 | 2424 | 2382 | 2341 | 0 |
| 1 | 2821 | 2775 | 2729 | 2684 | 2640 | 2596 | 2552 | 2509 | 2466 | 2424 | 2382 | 2340 | 1 |
| 2 | 2820 | 2774 | 2728 | 2683 | 2639 | 2595 | 2551 | 2508 | 2465 | 2423 | 2381 | 2339 | 2 |
| 3 | 2819 | 2773 | 2728 | 2683 | 2638 | 2594 | 2551 | 2507 | 2465 | 2422 | 2380 | 2339 | 3 |
| 4 | 2818 | 2772 | 2727 | 2682 | 2637 | 2593 | 2550 | 2507 | 2464 | 2421 | 2380 | 2338 | 4 |
| 5 | 2818 | 2772 | 2726 | 2681 | 2637 | 2593 | 2549 | 2506 | 2463 | 2421 | 2379 | 2337 | 5 |
| 6 | 2817 | 2771 | 2725 | 2681 | 2636 | 2592 | 2548 | 2505 | 2462 | 2420 | 2378 | 2337 | 6 |
| 7 | 2816 | 2770 | 2725 | 2680 | 2635 | 2591 | 2548 | 2504 | 2462 | 2419 | 2378 | 2336 | 7 |
| 8 | 2815 | 2769 | 2724 | 2679 | 2634 | 2590 | 2547 | 2504 | 2461 | 2419 | 2377 | 2335 | 8 |
| 9 | 2815 | 2769 | 2723 | 2678 | 2634 | 2590 | 2546 | 2503 | 2460 | 2418 | 2376 | 2335 | 9 |
| 10 | 2814 | 2768 | 2722 | 2678 | 2633 | 2589 | 2545 | 2502 | 2460 | 2417 | 2375 | 2334 | 10 |
| 11 | 2813 | 2767 | 2722 | 2677 | 2632 | 2588 | 2545 | 2502 | 2459 | 2417 | 2375 | 2333 | 11 |
| 12 | 2812 | 2766 | 2721 | 2676 | 2632 | 2588 | 2544 | 2501 | 2458 | 2416 | 2374 | 2333 | 12 |
| 13 | 2811 | 2766 | 2720 | 2675 | 2631 | 2587 | 2543 | 2500 | 2457 | 2415 | 2373 | 2332 | 13 |
| 14 | 2811 | 2765 | 2719 | 2675 | 2630 | 2586 | 2543 | 2499 | 2457 | 2414 | 2373 | 2331 | 14 |
| 15 | 2810 | 2764 | 2719 | 2674 | 2629 | 2585 | 2542 | 2499 | 2456 | 2414 | 2372 | 2331 | 15 |
| 16 | 2809 | 2763 | 2718 | 2673 | 2629 | 2585 | 2541 | 2498 | 2455 | 2413 | 2371 | 2330 | 16 |
| 17 | 2808 | 2763 | 2717 | 2672 | 2628 | 2584 | 2540 | 2497 | 2455 | 2412 | 2371 | 2329 | 17 |
| 18 | 2808 | 2762 | 2716 | 2672 | 2627 | 2583 | 2540 | 2497 | 2454 | 2412 | 2370 | 2328 | 18 |
| 19 | 2807 | 2761 | 2716 | 2671 | 2626 | 2582 | 2539 | 2496 | 2453 | 2411 | 2369 | 2328 | 19 |
| 20 | 2806 | 2760 | 2715 | 2670 | 2626 | 2582 | 2538 | 2495 | 2453 | 2410 | 2368 | 2327 | 20 |
| 21 | 2805 | 2760 | 2714 | 2669 | 2625 | 2581 | 2538 | 2494 | 2452 | 2410 | 2368 | 2326 | 21 |
| 22 | 2804 | 2759 | 2713 | 2669 | 2624 | 2580 | 2537 | 2494 | 2451 | 2409 | 2367 | 2326 | 22 |
| 23 | 2804 | 2758 | 2713 | 2668 | 2623 | 2580 | 2536 | 2493 | 2450 | 2408 | 2366 | 2325 | 23 |
| 24 | 2803 | 2757 | 2712 | 2667 | 2623 | 2579 | 2535 | 2492 | 2450 | 2408 | 2366 | 2324 | 24 |
| 25 | 2802 | 2756 | 2711 | 2666 | 2622 | 2578 | 2535 | 2492 | 2449 | 2407 | 2365 | 2324 | 25 |
| 26 | 2801 | 2756 | 2710 | 2666 | 2621 | 2577 | 2534 | 2491 | 2448 | 2406 | 2364 | 2323 | 26 |
| 27 | 2801 | 2755 | 2710 | 2665 | 2621 | 2577 | 2533 | 2490 | 2448 | 2405 | 2364 | 2322 | 27 |
| 28 | 2800 | 2754 | 2709 | 2664 | 2620 | 2576 | 2532 | 2489 | 2447 | 2405 | 2363 | 2322 | 28 |
| 29 | 2799 | 2753 | 2708 | 2663 | 2619 | 2575 | 2532 | 2489 | 2446 | 2404 | 2362 | 2321 | 29 |
| 30 | 2798 | 2753 | 2707 | 2663 | 2618 | 2574 | 2531 | 2488 | 2445 | 2403 | 2362 | 2320 | 30 |
| 31 | 2798 | 2752 | 2707 | 2662 | 2618 | 2574 | 2530 | 2487 | 2445 | 2403 | 2361 | 2319 | 31 |
| 32 | 2797 | 2751 | 2706 | 2661 | 2617 | 2573 | 2530 | 2487 | 2444 | 2402 | 2360 | 2319 | 32 |
| 33 | 2796 | 2750 | 2705 | 2660 | 2616 | 2572 | 2529 | 2486 | 2443 | 2401 | 2359 | 2318 | 33 |
| 34 | 2795 | 2750 | 2704 | 2660 | 2615 | 2572 | 2528 | 2485 | 2443 | 2400 | 2359 | 2317 | 34 |
| 35 | 2795 | 2749 | 2704 | 2659 | 2615 | 2571 | 2527 | 2484 | 2442 | 2400 | 2358 | 2317 | 35 |
| 36 | 2794 | 2748 | 2703 | 2658 | 2614 | 2570 | 2527 | 2484 | 2441 | 2399 | 2357 | 2316 | 36 |
| 37 | 2793 | 2747 | 2702 | 2657 | 2613 | 2569 | 2526 | 2483 | 2440 | 2398 | 2357 | 2315 | 37 |
| 38 | 2792 | 2747 | 2701 | 2657 | 2612 | 2569 | 2525 | 2482 | 2440 | 2398 | 2356 | 2315 | 38 |
| 39 | 2792 | 2746 | 2701 | 2656 | 2612 | 2568 | 2525 | 2482 | 2439 | 2397 | 2355 | 2314 | 39 |
| 40 | 2791 | 2745 | 2700 | 2655 | 2611 | 2567 | 2524 | 2481 | 2438 | 2396 | 2355 | 2313 | 40 |
| 41 | 2790 | 2744 | 2699 | 2654 | 2610 | 2566 | 2523 | 2480 | 2438 | 2396 | 2354 | 2313 | 41 |
| 42 | 2789 | 2744 | 2698 | 2654 | 2610 | 2566 | 2522 | 2480 | 2437 | 2395 | 2353 | 2312 | 42 |
| 43 | 2788 | 2743 | 2698 | 2653 | 2609 | 2565 | 2522 | 2479 | 2436 | 2394 | 2353 | 2311 | 43 |
| 44 | 2788 | 2742 | 2697 | 2652 | 2608 | 2564 | 2521 | 2478 | 2436 | 2394 | 2352 | 2311 | 44 |
| 45 | 2787 | 2741 | 2696 | 2652 | 2607 | 2564 | 2520 | 2477 | 2435 | 2393 | 2351 | 2310 | 45 |
| 46 | 2786 | 2741 | 2695 | 2651 | 2607 | 2563 | 2520 | 2477 | 2434 | 2392 | 2350 | 2309 | 46 |
| 47 | 2785 | 2740 | 2695 | 2650 | 2606 | 2562 | 2519 | 2476 | 2433 | 2391 | 2350 | 2308 | 47 |
| 48 | 2785 | 2739 | 2694 | 2649 | 2605 | 2561 | 2518 | 2475 | 2433 | 2391 | 2349 | 2308 | 48 |
| 49 | 2784 | 2738 | 2693 | 2649 | 2604 | 2561 | 2517 | 2474 | 2432 | 2390 | 2348 | 2307 | 49 |
| 50 | 2783 | 2738 | 2692 | 2648 | 2604 | 2560 | 2517 | 2474 | 2431 | 2389 | 2348 | 2306 | 50 |
| 51 | 2782 | 2737 | 2692 | 2647 | 2603 | 2559 | 2516 | 2473 | 2431 | 2389 | 2347 | 2306 | 51 |
| 52 | 2782 | 2736 | 2691 | 2646 | 2602 | 2558 | 2515 | 2472 | 2430 | 2388 | 2346 | 2305 | 52 |
| 53 | 2781 | 2735 | 2690 | 2646 | 2601 | 2558 | 2514 | 2472 | 2429 | 2387 | 2346 | 2304 | 53 |
| 54 | 2780 | 2735 | 2689 | 2645 | 2601 | 2557 | 2514 | 2471 | 2429 | 2387 | 2345 | 2304 | 54 |
| 55 | 2779 | 2734 | 2689 | 2644 | 2600 | 2556 | 2513 | 2470 | 2428 | 2386 | 2344 | 2303 | 55 |
| 56 | 2778 | 2733 | 2688 | 2643 | 2599 | 2556 | 2512 | 2470 | 2427 | 2385 | 2344 | 2302 | 56 |
| 57 | 2778 | 2732 | 2687 | 2643 | 2599 | 2555 | 2512 | 2469 | 2426 | 2384 | 2343 | 2302 | 57 |
| 58 | 2777 | 2731 | 2686 | 2642 | 2598 | 2554 | 2511 | 2468 | 2426 | 2384 | 2342 | 2301 | 58 |
| 59 | 2776 | 2731 | 2686 | 2641 | 2597 | 2553 | 2510 | 2467 | 2425 | 2383 | 2341 | 2300 | 59 |
| 60 | 2775 | 2730 | 2685 | 2640 | 2596 | 2553 | 2510 | 2467 | 2424 | 2382 | 2341 | 2300 | 60 |

TABLE XXVII.—(*continued*).

PROPORTIONAL LOGARITHMS

| sec. ″ | h m<br>1° 46′ | h m<br>1° 47′ | h m<br>1° 48′ | h m<br>1° 49′ | h m<br>1° 50′ | h m<br>1° 51′ | h m<br>1° 52′ | h m<br>1° 53′ | h m<br>1° 54′ | h m<br>1° 55′ | h m<br>1° 56′ | h m<br>1° 57′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2300 | 2259 | 2218 | 2178 | 2139 | 2099 | 2061 | 2022 | 1984 | 1946 | 1908 | 1871 | 0 |
| 1 | 2299 | 2258 | 2218 | 2178 | 2138 | 2099 | 2060 | 2021 | 1983 | 1945 | 1907 | 1870 | 1 |
| 2 | 2298 | 2257 | 2217 | 2177 | 2137 | 2098 | 2059 | 2021 | 1982 | 1944 | 1907 | 1870 | 2 |
| 3 | 2298 | 2257 | 2216 | 2176 | 2137 | 2098 | 2059 | 2020 | 1982 | 1944 | 1906 | 1869 | 3 |
| 4 | 2297 | 2256 | 2216 | 2176 | 2136 | 2097 | 2058 | 2019 | 1981 | 1943 | 1906 | 1868 | 4 |
| 5 | 2296 | 2255 | 2215 | 2175 | 2135 | 2096 | 2057 | 2019 | 1980 | 1943 | 1905 | 1868 | 5 |
| 6 | 2296 | 2255 | 2214 | 2174 | 2135 | 2096 | 2057 | 2018 | 1980 | 1942 | 1904 | 1867 | 6 |
| 7 | 2295 | 2254 | 2214 | 2174 | 2134 | 2095 | 2056 | 2017 | 1979 | 1941 | 1904 | 1867 | 7 |
| 8 | 2294 | 2253 | 2213 | 2173 | 2133 | 2094 | 2055 | 2017 | 1979 | 1941 | 1903 | 1866 | 8 |
| 9 | 2294 | 2253 | 2212 | 2172 | 2133 | 2094 | 2055 | 2016 | 1978 | 1940 | 1903 | 1865 | 9 |
| 10 | 2293 | 2252 | 2212 | 2172 | 2132 | 2093 | 2054 | 2016 | 1977 | 1939 | 1902 | 1865 | 10 |
| 11 | 2292 | 2251 | 2211 | 2171 | 2132 | 2092 | 2053 | 2015 | 1977 | 1939 | 1901 | 1864 | 11 |
| 12 | 2291 | 2251 | 2210 | 2170 | 2131 | 2092 | 2053 | 2014 | 1976 | 1938 | 1901 | 1863 | 12 |
| 13 | 2291 | 2250 | 2210 | 2170 | 2130 | 2091 | 2052 | 2014 | 1975 | 1938 | 1900 | 1863 | 13 |
| 14 | 2290 | 2249 | 2209 | 2169 | 2130 | 2090 | 2051 | 2013 | 1975 | 1937 | 1899 | 1862 | 14 |
| 15 | 2289 | 2249 | 2208 | 2169 | 2129 | 2090 | 2051 | 2012 | 1974 | 1936 | 1899 | 1862 | 15 |
| 16 | 2289 | 2248 | 2208 | 2168 | 2128 | 2089 | 2050 | 2012 | 1973 | 1936 | 1898 | 1861 | 16 |
| 17 | 2288 | 2247 | 2207 | 2167 | 2128 | 2088 | 2050 | 2011 | 1973 | 1935 | 1898 | 1860 | 17 |
| 18 | 2287 | 2247 | 2206 | 2167 | 2127 | 2088 | 2049 | 2010 | 1972 | 1934 | 1897 | 1860 | 18 |
| 19 | 2287 | 2246 | 2206 | 2166 | 2126 | 2087 | 2048 | 2010 | 1972 | 1934 | 1896 | 1859 | 19 |
| 20 | 2286 | 2245 | 2205 | 2165 | 2126 | 2086 | 2048 | 2009 | 1971 | 1933 | 1896 | 1858 | 20 |
| 21 | 2285 | 2245 | 2204 | 2165 | 2125 | 2086 | 2047 | 2009 | 1970 | 1933 | 1895 | 1858 | 21 |
| 22 | 2285 | 2244 | 2204 | 2164 | 2124 | 2085 | 2046 | 2008 | 1970 | 1932 | 1894 | 1857 | 22 |
| 23 | 2284 | 2243 | 2203 | 2163 | 2124 | 2084 | 2046 | 2007 | 1969 | 1931 | 1894 | 1857 | 23 |
| 24 | 2283 | 2243 | 2202 | 2163 | 2123 | 2084 | 2045 | 2007 | 1968 | 1931 | 1893 | 1856 | 24 |
| 25 | 2283 | 2242 | 2202 | 2162 | 2122 | 2083 | 2044 | 2006 | 1968 | 1930 | 1893 | 1855 | 25 |
| 26 | 2282 | 2241 | 2201 | 2161 | 2122 | 2083 | 2044 | 2005 | 1967 | 1929 | 1892 | 1855 | 26 |
| 27 | 2281 | 2241 | 2200 | 2161 | 2121 | 2082 | 2043 | 2005 | 1967 | 1929 | 1891 | 1854 | 27 |
| 28 | 2281 | 2240 | 2200 | 2160 | 2120 | 2081 | 2042 | 2004 | 1966 | 1928 | 1891 | 1854 | 28 |
| 29 | 2280 | 2239 | 2199 | 2159 | 2120 | 2081 | 2042 | 2003 | 1965 | 1927 | 1890 | 1853 | 29 |
| 30 | 2279 | 2239 | 2198 | 2159 | 2119 | 2080 | 2041 | 2003 | 1965 | 1927 | 1889 | 1852 | 30 |
| 31 | 2279 | 2238 | 2198 | 2158 | 2118 | 2079 | 2041 | 2002 | 1964 | 1926 | 1889 | 1852 | 31 |
| 32 | 2278 | 2237 | 2197 | 2157 | 2118 | 2079 | 2040 | 2001 | 1963 | 1926 | 1888 | 1851 | 32 |
| 33 | 2277 | 2237 | 2196 | 2157 | 2117 | 2078 | 2039 | 2001 | 1963 | 1925 | 1888 | 1850 | 33 |
| 34 | 2276 | 2236 | 2196 | 2156 | 2116 | 2077 | 2039 | 2000 | 1962 | 1924 | 1887 | 1850 | 34 |
| 35 | 2276 | 2235 | 2195 | 2155 | 2116 | 2077 | 2038 | 2000 | 1961 | 1924 | 1886 | 1849 | 35 |
| 36 | 2275 | 2235 | 2194 | 2155 | 2115 | 2076 | 2037 | 1999 | 1961 | 1923 | 1886 | 1849 | 36 |
| 37 | 2274 | 2234 | 2194 | 2154 | 2114 | 2075 | 2037 | 1998 | 1960 | 1922 | 1885 | 1848 | 37 |
| 38 | 2274 | 2233 | 2193 | 2153 | 2114 | 2075 | 2036 | 1998 | 1960 | 1922 | 1884 | 1847 | 38 |
| 39 | 2273 | 2233 | 2192 | 2153 | 2113 | 2074 | 2035 | 1997 | 1959 | 1921 | 1884 | 1847 | 39 |
| 40 | 2272 | 2232 | 2192 | 2152 | 2113 | 2073 | 2035 | 1996 | 1958 | 1921 | 1883 | 1846 | 40 |
| 41 | 2272 | 2231 | 2191 | 2151 | 2112 | 2073 | 2034 | 1996 | 1958 | 1920 | 1883 | 1846 | 41 |
| 42 | 2271 | 2231 | 2190 | 2151 | 2111 | 2072 | 2033 | 1995 | 1957 | 1919 | 1882 | 1845 | 42 |
| 43 | 2270 | 2230 | 2190 | 2150 | 2111 | 2071 | 2033 | 1994 | 1956 | 1919 | 1881 | 1844 | 43 |
| 44 | 2270 | 2229 | 2189 | 2149 | 2110 | 2071 | 2032 | 1994 | 1956 | 1918 | 1881 | 1844 | 44 |
| 45 | 2269 | 2229 | 2188 | 2149 | 2109 | 2070 | 2032 | 1993 | 1955 | 1918 | 1880 | 1843 | 45 |
| 46 | 2268 | 2228 | 2188 | 2148 | 2109 | 2070 | 2031 | 1993 | 1955 | 1917 | 1879 | 1842 | 46 |
| 47 | 2268 | 2227 | 2187 | 2147 | 2108 | 2069 | 2030 | 1992 | 1954 | 1916 | 1879 | 1842 | 47 |
| 48 | 2267 | 2227 | 2186 | 2147 | 2107 | 2068 | 2030 | 1991 | 1953 | 1916 | 1878 | 1841 | 48 |
| 49 | 2266 | 2226 | 2186 | 2146 | 2107 | 2068 | 2029 | 1991 | 1953 | 1915 | 1878 | 1841 | 49 |
| 50 | 2266 | 2225 | 2185 | 2145 | 2106 | 2067 | 2028 | 1990 | 1952 | 1914 | 1877 | 1840 | 50 |
| 51 | 2265 | 2225 | 2184 | 2145 | 2105 | 2066 | 2028 | 1989 | 1951 | 1914 | 1876 | 1839 | 51 |
| 52 | 2264 | 2224 | 2184 | 2144 | 2105 | 2066 | 2027 | 1989 | 1951 | 1913 | 1876 | 1839 | 52 |
| 53 | 2264 | 2223 | 2183 | 2143 | 2104 | 2065 | 2026 | 1988 | 1950 | 1912 | 1875 | 1838 | 53 |
| 54 | 2263 | 2223 | 2182 | 2143 | 2103 | 2064 | 2026 | 1987 | 1950 | 1912 | 1875 | 1838 | 54 |
| 55 | 2262 | 2222 | 2182 | 2142 | 2103 | 2064 | 2025 | 1987 | 1949 | 1911 | 1874 | 1837 | 55 |
| 56 | 2262 | 2221 | 2181 | 2141 | 2102 | 2063 | 2024 | 1986 | 1948 | 1911 | 1873 | 1836 | 56 |
| 57 | 2261 | 2220 | 2180 | 2141 | 2101 | 2062 | 2024 | 1986 | 1948 | 1910 | 1873 | 1836 | 57 |
| 58 | 2260 | 2220 | 2180 | 2140 | 2101 | 2062 | 2023 | 1985 | 1947 | 1909 | 1872 | 1835 | 58 |
| 59 | 2260 | 2219 | 2179 | 2139 | 2100 | 2061 | 2023 | 1984 | 1946 | 1909 | 1871 | 1834 | 59 |
| 60 | 2259 | 2218 | 2178 | 2139 | 2099 | 2061 | 2022 | 1984 | 1946 | 1908 | 1871 | 1834 | 60 |

TABLE XXVII.—(*continued*).

**PROPORTIONAL LOGARITHMS**

| sec. " | h m 1° 58′ | h m 1° 59′ | h m 2° 0′ | h m 2° 1′ | h m 2° 2′ | h m 2° 3′ | h m 2° 4′ | h m 2° 5′ | h m 2° 6′ | h m 2° 7′ | h m 2° 8′ | h m 2° 9′ | h m 2° 10′ | sec. " |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1834 | 1797 | 1761 | 1725 | 1689 | 1654 | 1619 | 1584 | 1549 | 1515 | 1481 | 1447 | 1413 | 0 |
| 1 | 1833 | 1797 | 1760 | 1724 | 1688 | 1653 | 1618 | 1583 | 1548 | 1514 | 1480 | 1446 | 1413 | 1 |
| 2 | 1833 | 1796 | 1760 | 1724 | 1688 | 1652 | 1617 | 1582 | 1548 | 1514 | 1479 | 1446 | 1412 | 2 |
| 3 | 1832 | 1795 | 1759 | 1723 | 1687 | 1652 | 1617 | 1582 | 1547 | 1513 | 1479 | 1445 | 1412 | 3 |
| 4 | 1831 | 1795 | 1758 | 1722 | 1687 | 1651 | 1616 | 1581 | 1547 | 1512 | 1478 | 1445 | 1411 | 4 |
| 5 | 1831 | 1794 | 1758 | 1722 | 1686 | 1651 | 1616 | 1581 | 1546 | 1512 | 1478 | 1444 | 1410 | 5 |
| 6 | 1830 | 1794 | 1757 | 1721 | 1686 | 1650 | 1615 | 1580 | 1546 | 1511 | 1477 | 1443 | 1410 | 6 |
| 7 | 1830 | 1793 | 1757 | 1721 | 1685 | 1650 | 1614 | 1580 | 1545 | 1511 | 1477 | 1443 | 1409 | 7 |
| 8 | 1829 | 1792 | 1756 | 1720 | 1684 | 1649 | 1614 | 1579 | 1544 | 1510 | 1476 | 1442 | 1409 | 8 |
| 9 | 1828 | 1792 | 1755 | 1719 | 1684 | 1648 | 1613 | 1578 | 1544 | 1510 | 1476 | 1442 | 1408 | 9 |
| 10 | 1828 | 1791 | 1755 | 1719 | 1683 | 1648 | 1613 | 1578 | 1543 | 1509 | 1475 | 1441 | 1408 | 10 |
| 11 | 1827 | 1791 | 1754 | 1718 | 1683 | 1647 | 1612 | 1577 | 1543 | 1508 | 1474 | 1441 | 1407 | 11 |
| 12 | 1827 | 1790 | 1754 | 1718 | 1682 | 1647 | 1612 | 1577 | 1542 | 1508 | 1474 | 1440 | 1407 | 12 |
| 13 | 1826 | 1789 | 1753 | 1717 | 1681 | 1646 | 1611 | 1576 | 1542 | 1507 | 1473 | 1440 | 1406 | 13 |
| 14 | 1825 | 1789 | 1752 | 1716 | 1681 | 1645 | 1610 | 1575 | 1541 | 1507 | 1473 | 1439 | 1405 | 14 |
| 15 | 1825 | 1788 | 1752 | 1716 | 1680 | 1645 | 1610 | 1575 | 1540 | 1506 | 1472 | 1438 | 1405 | 15 |
| 16 | 1824 | 1787 | 1751 | 1715 | 1680 | 1644 | 1609 | 1574 | 1540 | 1506 | 1472 | 1438 | 1404 | 16 |
| 17 | 1823 | 1787 | 1751 | 1715 | 1679 | 1644 | 1609 | 1574 | 1539 | 1505 | 1471 | 1437 | 1404 | 17 |
| 18 | 1823 | 1786 | 1750 | 1714 | 1678 | 1643 | 1608 | 1573 | 1539 | 1504 | 1470 | 1437 | 1403 | 18 |
| 19 | 1822 | 1786 | 1749 | 1713 | 1678 | 1642 | 1607 | 1573 | 1538 | 1504 | 1470 | 1436 | 1403 | 19 |
| 20 | 1822 | 1785 | 1749 | 1713 | 1677 | 1642 | 1607 | 1572 | 1538 | 1503 | 1469 | 1436 | 1402 | 20 |
| 21 | 1821 | 1785 | 1748 | 1712 | 1677 | 1641 | 1606 | 1571 | 1537 | 1503 | 1469 | 1435 | 1402 | 21 |
| 22 | 1820 | 1784 | 1748 | 1712 | 1676 | 1641 | 1606 | 1571 | 1536 | 1502 | 1468 | 1434 | 1401 | 22 |
| 23 | 1820 | 1783 | 1747 | 1711 | 1675 | 1640 | 1605 | 1570 | 1536 | 1502 | 1468 | 1434 | 1400 | 23 |
| 24 | 1819 | 1783 | 1746 | 1711 | 1675 | 1640 | 1605 | 1570 | 1535 | 1501 | 1467 | 1433 | 1400 | 24 |
| 25 | 1819 | 1782 | 1746 | 1710 | 1674 | 1639 | 1604 | 1569 | 1535 | 1500 | 1466 | 1433 | 1399 | 25 |
| 26 | 1818 | 1781 | 1745 | 1709 | 1674 | 1638 | 1603 | 1569 | 1534 | 1500 | 1466 | 1432 | 1399 | 26 |
| 27 | 1817 | 1781 | 1745 | 1709 | 1673 | 1638 | 1603 | 1568 | 1534 | 1499 | 1465 | 1432 | 1398 | 27 |
| 28 | 1817 | 1780 | 1744 | 1708 | 1673 | 1637 | 1602 | 1567 | 1533 | 1499 | 1465 | 1431 | 1398 | 28 |
| 29 | 1816 | 1780 | 1743 | 1708 | 1672 | 1637 | 1602 | 1567 | 1532 | 1498 | 1464 | 1431 | 1397 | 29 |
| 30 | 1816 | 1779 | 1743 | 1707 | 1671 | 1636 | 1601 | 1566 | 1532 | 1498 | 1464 | 1430 | 1397 | 30 |
| 31 | 1815 | 1778 | 1742 | 1706 | 1671 | 1635 | 1600 | 1566 | 1531 | 1497 | 1463 | 1429 | 1396 | 31 |
| 32 | 1814 | 1778 | 1742 | 1706 | 1670 | 1635 | 1600 | 1565 | 1531 | 1496 | 1463 | 1429 | 1395 | 32 |
| 33 | 1814 | 1777 | 1741 | 1705 | 1670 | 1634 | 1599 | 1565 | 1530 | 1496 | 1462 | 1428 | 1395 | 33 |
| 34 | 1813 | 1777 | 1740 | 1705 | 1669 | 1634 | 1599 | 1564 | 1529 | 1495 | 1461 | 1428 | 1394 | 34 |
| 35 | 1812 | 1776 | 1740 | 1704 | 1668 | 1633 | 1598 | 1563 | 1529 | 1495 | 1461 | 1427 | 1394 | 35 |
| 36 | 1812 | 1775 | 1739 | 1703 | 1668 | 1633 | 1598 | 1563 | 1528 | 1494 | 1460 | 1427 | 1393 | 36 |
| 37 | 1811 | 1775 | 1739 | 1703 | 1667 | 1632 | 1597 | 1562 | 1528 | 1494 | 1460 | 1426 | 1393 | 37 |
| 38 | 1811 | 1774 | 1738 | 1702 | 1667 | 1631 | 1596 | 1562 | 1527 | 1493 | 1459 | 1426 | 1392 | 38 |
| 39 | 1810 | 1774 | 1737 | 1702 | 1666 | 1631 | 1596 | 1561 | 1527 | 1493 | 1459 | 1425 | 1392 | 39 |
| 40 | 1809 | 1773 | 1737 | 1701 | 1665 | 1630 | 1595 | 1560 | 1526 | 1492 | 1458 | 1424 | 1391 | 40 |
| 41 | 1809 | 1772 | 1736 | 1700 | 1665 | 1630 | 1595 | 1560 | 1525 | 1491 | 1457 | 1424 | 1390 | 41 |
| 42 | 1808 | 1772 | 1736 | 1700 | 1664 | 1629 | 1594 | 1559 | 1525 | 1491 | 1457 | 1423 | 1390 | 42 |
| 43 | 1808 | 1771 | 1735 | 1699 | 1664 | 1628 | 1593 | 1559 | 1524 | 1490 | 1456 | 1423 | 1389 | 43 |
| 44 | 1807 | 1771 | 1734 | 1699 | 1663 | 1628 | 1593 | 1558 | 1524 | 1490 | 1456 | 1422 | 1389 | 44 |
| 45 | 1806 | 1770 | 1734 | 1698 | 1663 | 1627 | 1592 | 1558 | 1523 | 1489 | 1455 | 1422 | 1388 | 45 |
| 46 | 1806 | 1769 | 1733 | 1697 | 1662 | 1627 | 1592 | 1557 | 1523 | 1489 | 1455 | 1421 | 1388 | 46 |
| 47 | 1805 | 1769 | 1733 | 1697 | 1661 | 1626 | 1591 | 1556 | 1522 | 1488 | 1454 | 1420 | 1387 | 47 |
| 48 | 1805 | 1768 | 1732 | 1696 | 1661 | 1626 | 1591 | 1556 | 1522 | 1487 | 1454 | 1420 | 1387 | 48 |
| 49 | 1804 | 1768 | 1731 | 1696 | 1660 | 1625 | 1590 | 1555 | 1521 | 1487 | 1453 | 1419 | 1386 | 49 |
| 50 | 1803 | 1767 | 1731 | 1695 | 1660 | 1624 | 1589 | 1555 | 1520 | 1486 | 1452 | 1419 | 1386 | 50 |
| 51 | 1803 | 1766 | 1730 | 1694 | 1659 | 1624 | 1589 | 1554 | 1520 | 1486 | 1452 | 1418 | 1385 | 51 |
| 52 | 1802 | 1766 | 1730 | 1694 | 1658 | 1623 | 1588 | 1554 | 1519 | 1485 | 1451 | 1418 | 1384 | 52 |
| 53 | 1801 | 1765 | 1729 | 1693 | 1658 | 1623 | 1588 | 1553 | 1518 | 1485 | 1451 | 1417 | 1384 | 53 |
| 54 | 1801 | 1765 | 1728 | 1693 | 1657 | 1622 | 1587 | 1552 | 1518 | 1484 | 1450 | 1417 | 1383 | 54 |
| 55 | 1800 | 1764 | 1728 | 1692 | 1657 | 1621 | 1586 | 1552 | 1518 | 1483 | 1450 | 1416 | 1383 | 55 |
| 56 | 1800 | 1763 | 1727 | 1691 | 1656 | 1621 | 1586 | 1551 | 1517 | 1483 | 1449 | 1415 | 1382 | 56 |
| 57 | 1799 | 1763 | 1727 | 1691 | 1655 | 1620 | 1585 | 1551 | 1516 | 1482 | 1449 | 1415 | 1382 | 57 |
| 58 | 1798 | 1762 | 1726 | 1690 | 1655 | 1620 | 1585 | 1550 | 1516 | 1482 | 1448 | 1414 | 1381 | 58 |
| 59 | 1798 | 1761 | 1725 | 1690 | 1654 | 1619 | 1584 | 1550 | 1515 | 1481 | 1447 | 1414 | 1381 | 59 |
| 60 | 1797 | 1761 | 1725 | 1689 | 1654 | 1019 | 1584 | 1549 | 1515 | 1481 | 1447 | 1413 | 1380 | 60 |

## TABLE XXVII.—(*continued*).

### PROPORTIONAL LOGARITHMS

| sec. ″ | h m 2° 11′ | h m 2° 12′ | h m 2° 13′ | h m 2° 14′ | h m 2° 15′ | h m 2° 16′ | h m 2° 17′ | h m 2° 18′ | h m 2° 19′ | h m 2° 20′ | h m 2° 21′ | h m 2° 22′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1380 | 1347 | 1314 | 1282 | 1249 | 1217 | 1186 | 1154 | 1123 | 1091 | 1061 | 1030 | 0 |
| 1 | 1379 | 1346 | 1314 | 1281 | 1249 | 1217 | 1185 | 1153 | 1122 | 1091 | 1060 | 1029 | 1 |
| 2 | 1379 | 1346 | 1313 | 1281 | 1248 | 1216 | 1184 | 1153 | 1121 | 1090 | 1059 | 1029 | 2 |
| 3 | 1378 | 1345 | 1313 | 1280 | 1248 | 1216 | 1184 | 1152 | 1121 | 1090 | 1059 | 1028 | 3 |
| 4 | 1378 | 1345 | 1312 | 1279 | 1247 | 1215 | 1183 | 1152 | 1120 | 1089 | 1058 | 1028 | 4 |
| 5 | 1377 | 1344 | 1311 | 1279 | 1247 | 1215 | 1183 | 1151 | 1120 | 1089 | 1058 | 1027 | 5 |
| 6 | 1377 | 1344 | 1311 | 1278 | 1246 | 1214 | 1182 | 1151 | 1119 | 1088 | 1057 | 1027 | 6 |
| 7 | 1376 | 1343 | 1310 | 1278 | 1246 | 1214 | 1182 | 1150 | 1119 | 1088 | 1057 | 1026 | 7 |
| 8 | 1376 | 1343 | 1310 | 1277 | 1245 | 1213 | 1181 | 1150 | 1118 | 1087 | 1056 | 1026 | 8 |
| 9 | 1375 | 1342 | 1309 | 1277 | 1245 | 1213 | 1181 | 1149 | 1118 | 1087 | 1056 | 1025 | 9 |
| 10 | 1374 | 1341 | 1309 | 1276 | 1244 | 1212 | 1180 | 1149 | 1117 | 1086 | 1055 | 1025 | 10 |
| 11 | 1374 | 1341 | 1308 | 1276 | 1243 | 1211 | 1180 | 1148 | 1117 | 1086 | 1055 | 1024 | 11 |
| 12 | 1373 | 1340 | 1308 | 1275 | 1243 | 1211 | 1179 | 1148 | 1116 | 1085 | 1054 | 1024 | 12 |
| 13 | 1373 | 1340 | 1307 | 1275 | 1242 | 1210 | 1179 | 1147 | 1116 | 1085 | 1054 | 1023 | 13 |
| 14 | 1372 | 1339 | 1307 | 1274 | 1242 | 1210 | 1178 | 1147 | 1115 | 1084 | 1053 | 1023 | 14 |
| 15 | 1372 | 1339 | 1306 | 1274 | 1241 | 1209 | 1178 | 1146 | 1115 | 1084 | 1053 | 1022 | 15 |
| 16 | 1371 | 1338 | 1305 | 1273 | 1241 | 1209 | 1177 | 1146 | 1114 | 1083 | 1052 | 1022 | 16 |
| 17 | 1371 | 1338 | 1305 | 1272 | 1240 | 1208 | 1177 | 1145 | 1114 | 1083 | 1052 | 1021 | 17 |
| 18 | 1370 | 1337 | 1304 | 1272 | 1240 | 1208 | 1176 | 1145 | 1113 | 1082 | 1051 | 1021 | 18 |
| 19 | 1369 | 1337 | 1304 | 1271 | 1239 | 1207 | 1175 | 1144 | 1113 | 1082 | 1051 | 1020 | 19 |
| 20 | 1369 | 1336 | 1303 | 1271 | 1239 | 1207 | 1175 | 1143 | 1112 | 1081 | 1050 | 1020 | 20 |
| 21 | 1368 | 1335 | 1303 | 1270 | 1238 | 1206 | 1174 | 1143 | 1112 | 1081 | 1050 | 1019 | 21 |
| 22 | 1368 | 1335 | 1302 | 1270 | 1238 | 1206 | 1174 | 1142 | 1111 | 1080 | 1049 | 1019 | 22 |
| 23 | 1367 | 1334 | 1302 | 1269 | 1237 | 1205 | 1173 | 1142 | 1111 | 1080 | 1049 | 1018 | 23 |
| 24 | 1367 | 1334 | 1301 | 1269 | 1237 | 1205 | 1173 | 1141 | 1110 | 1079 | 1048 | 1018 | 24 |
| 25 | 1366 | 1333 | 1301 | 1268 | 1236 | 1204 | 1172 | 1141 | 1110 | 1079 | 1048 | 1017 | 25 |
| 26 | 1366 | 1333 | 1300 | 1268 | 1235 | 1203 | 1172 | 1140 | 1109 | 1078 | 1047 | 1017 | 26 |
| 27 | 1365 | 1332 | 1300 | 1267 | 1235 | 1203 | 1171 | 1140 | 1109 | 1078 | 1047 | 1016 | 27 |
| 28 | 1365 | 1332 | 1299 | 1267 | 1234 | 1202 | 1171 | 1139 | 1108 | 1077 | 1046 | 1016 | 28 |
| 29 | 1364 | 1331 | 1298 | 1266 | 1234 | 1202 | 1170 | 1139 | 1107 | 1076 | 1046 | 1015 | 29 |
| 30 | 1363 | 1331 | 1298 | 1266 | 1233 | 1201 | 1170 | 1138 | 1107 | 1076 | 1045 | 1015 | 30 |
| 31 | 1363 | 1330 | 1297 | 1265 | 1233 | 1201 | 1169 | 1138 | 1106 | 1075 | 1045 | 1014 | 31 |
| 32 | 1362 | 1329 | 1297 | 1264 | 1232 | 1200 | 1169 | 1137 | 1106 | 1075 | 1044 | 1014 | 32 |
| 33 | 1362 | 1329 | 1296 | 1264 | 1232 | 1200 | 1168 | 1137 | 1105 | 1074 | 1044 | 1013 | 33 |
| 34 | 1361 | 1328 | 1296 | 1263 | 1231 | 1199 | 1168 | 1136 | 1105 | 1074 | 1043 | 1013 | 34 |
| 35 | 1361 | 1328 | 1295 | 1263 | 1231 | 1199 | 1167 | 1136 | 1104 | 1073 | 1043 | 1012 | 35 |
| 36 | 1360 | 1327 | 1295 | 1262 | 1230 | 1198 | 1167 | 1135 | 1104 | 1073 | 1042 | 1012 | 36 |
| 37 | 1360 | 1327 | 1294 | 1262 | 1230 | 1198 | 1166 | 1135 | 1103 | 1072 | 1042 | 1011 | 37 |
| 38 | 1359 | 1326 | 1294 | 1261 | 1229 | 1197 | 1165 | 1134 | 1103 | 1072 | 1041 | 1010 | 38 |
| 39 | 1359 | 1326 | 1293 | 1261 | 1229 | 1197 | 1165 | 1134 | 1102 | 1071 | 1041 | 1010 | 39 |
| 40 | 1358 | 1325 | 1292 | 1260 | 1228 | 1196 | 1164 | 1133 | 1102 | 1071 | 1040 | 1009 | 40 |
| 41 | 1357 | 1325 | 1292 | 1260 | 1227 | 1196 | 1164 | 1132 | 1101 | 1070 | 1039 | 1009 | 41 |
| 42 | 1357 | 1324 | 1291 | 1259 | 1227 | 1195 | 1163 | 1132 | 1101 | 1070 | 1039 | 1008 | 42 |
| 43 | 1356 | 1323 | 1291 | 1258 | 1226 | 1194 | 1163 | 1131 | 1100 | 1069 | 1038 | 1008 | 43 |
| 44 | 1356 | 1323 | 1290 | 1258 | 1226 | 1194 | 1162 | 1131 | 1100 | 1069 | 1038 | 1007 | 44 |
| 45 | 1355 | 1322 | 1290 | 1257 | 1225 | 1193 | 1162 | 1130 | 1099 | 1068 | 1037 | 1007 | 45 |
| 46 | 1355 | 1322 | 1289 | 1257 | 1225 | 1193 | 1161 | 1130 | 1099 | 1068 | 1037 | 1006 | 46 |
| 47 | 1354 | 1321 | 1289 | 1256 | 1224 | 1192 | 1161 | 1129 | 1098 | 1067 | 1036 | 1006 | 47 |
| 48 | 1354 | 1321 | 1288 | 1256 | 1224 | 1192 | 1160 | 1129 | 1098 | 1067 | 1036 | 1005 | 48 |
| 40 | 1353 | 1320 | 1288 | 1255 | 1223 | 1191 | 1160 | 1128 | 1097 | 1066 | 1035 | 1005 | 49 |
| 50 | 1352 | 1320 | 1287 | 1255 | 1223 | 1191 | 1159 | 1128 | 1097 | 1066 | 1035 | 1004 | 50 |
| 51 | 1352 | 1319 | 1287 | 1254 | 1222 | 1190 | 1159 | 1127 | 1096 | 1065 | 1034 | 1004 | 51 |
| 52 | 1351 | 1319 | 1286 | 1254 | 1222 | 1190 | 1158 | 1127 | 1096 | 1065 | 1034 | 1003 | 52 |
| 53 | 1351 | 1318 | 1285 | 1253 | 1221 | 1189 | 1158 | 1126 | 1095 | 1064 | 1033 | 1003 | 53 |
| 54 | 1350 | 1317 | 1285 | 1253 | 1221 | 1189 | 1157 | 1126 | 1095 | 1064 | 1033 | 1002 | 54 |
| 55 | 1350 | 1317 | 1284 | 1252 | 1220 | 1188 | 1157 | 1125 | 1094 | 1063 | 1032 | 1002 | 55 |
| 56 | 1349 | 1316 | 1284 | 1251 | 1219 | 1188 | 1156 | 1125 | 1093 | 1063 | 1032 | 1001 | 56 |
| 57 | 1349 | 1316 | 1283 | 1251 | 1219 | 1187 | 1156 | 1124 | 1093 | 1062 | 1031 | 1001 | 57 |
| 58 | 1348 | 1315 | 1283 | 1250 | 1218 | 1187 | 1155 | 1124 | 1092 | 1062 | 1031 | 1000 | 58 |
| 59 | 1347 | 1315 | 1282 | 1250 | 1218 | 1186 | 1154 | 1123 | 1092 | 1061 | 1030 | 1000 | 59 |
| 60 | 1347 | 1314 | 1282 | 1249 | 1217 | 1186 | 1154 | 1123 | 1091 | 1061 | 1030 | 0999 | 60 |

TABLE XXVII.—(*continued*).

**PROPORTIONAL LOGARITHMS**

| sec. ″ | h m 2° 23′ | h m 2° 24′ | h m 2° 25′ | h m 2° 26′ | h m 2° 27′ | h m 2° 28′ | h m 2° 29′ | h m 2° 30′ | h m 2° 31′ | h m 2° 32′ | h m 2° 33′ | h m 2° 34′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0999 | 0969 | 0939 | 0909 | 0880 | 0850 | 0821 | 0792 | 0763 | 0734 | 0706 | 0678 | 0 |
| 1 | 0999 | 0969 | 0939 | 0909 | 0879 | 0850 | 0820 | 0791 | 0762 | 0734 | 0705 | 0677 | 1 |
| 2 | 0998 | 0968 | 0938 | 0908 | 0879 | 0849 | 0820 | 0791 | 0762 | 0733 | 0705 | 0677 | 2 |
| 3 | 0998 | 0968 | 0938 | 0908 | 0878 | 0849 | 0819 | 0790 | 0762 | 0733 | 0704 | 0676 | 3 |
| 4 | 0997 | 0967 | 0937 | 0907 | 0878 | 0848 | 0819 | 0790 | 0761 | 0732 | 0704 | 0676 | 4 |
| 5 | 0997 | 0967 | 0937 | 0907 | 0877 | 0848 | 0818 | 0789 | 0761 | 0732 | 0703 | 0675 | 5 |
| 6 | 0996 | 0966 | 0936 | 0906 | 0877 | 0847 | 0818 | 0789 | 0760 | 0731 | 0703 | 0675 | 6 |
| 7 | 0996 | 0966 | 0936 | 0906 | 0876 | 0847 | 0817 | 0788 | 0760 | 0731 | 0702 | 0674 | 7 |
| 8 | 0995 | 0965 | 0935 | 0905 | 0876 | 0846 | 0817 | 0788 | 0759 | 0730 | 0702 | 0674 | 8 |
| 9 | 0995 | 0965 | 0935 | 0905 | 0875 | 0846 | 0816 | 0787 | 0759 | 0730 | 0702 | 0673 | 9 |
| 10 | 0994 | 0964 | 0934 | 0904 | 0875 | 0845 | 0816 | 0787 | 0758 | 0729 | 0701 | 0673 | 10 |
| 11 | 0994 | 0964 | 0934 | 0904 | 0874 | 0845 | 0815 | 0787 | 0758 | 0729 | 0701 | 0672 | 11 |
| 12 | 0993 | 0963 | 0933 | 0903 | 0874 | 0844 | 0815 | 0786 | 0757 | 0729 | 0700 | 0672 | 12 |
| 13 | 0993 | 0963 | 0933 | 0903 | 0873 | 0844 | 0815 | 0786 | 0757 | 0728 | 0700 | 0671 | 13 |
| 14 | 0992 | 0962 | 0932 | 0902 | 0873 | 0843 | 0814 | 0785 | 0756 | 0728 | 0699 | 0671 | 14 |
| 15 | 0992 | 0962 | 0932 | 0902 | 0872 | 0843 | 0814 | 0785 | 0756 | 0727 | 0699 | 0670 | 15 |
| 16 | 0991 | 0961 | 0931 | 0901 | 0872 | 0842 | 0813 | 0784 | 0755 | 0727 | 0698 | 0670 | 16 |
| 17 | 0991 | 0961 | 0931 | 0901 | 0871 | 0842 | 0813 | 0784 | 0755 | 0726 | 0698 | 0669 | 17 |
| 18 | 0990 | 0960 | 0930 | 0900 | 0871 | 0841 | 0812 | 0783 | 0754 | 0726 | 0697 | 0669 | 18 |
| 19 | 0990 | 0960 | 0930 | 0900 | 0870 | 0841 | 0812 | 0783 | 0754 | 0725 | 0697 | 0669 | 19 |
| 20 | 0989 | 0959 | 0929 | 0899 | 0870 | 0840 | 0811 | 0782 | 0753 | 0725 | 0696 | 0668 | 20 |
| 21 | 0989 | 0959 | 0929 | 0899 | 0869 | 0840 | 0811 | 0782 | 0753 | 0724 | 0696 | 0668 | 21 |
| 22 | 0988 | 0958 | 0928 | 0898 | 0869 | 0839 | 0810 | 0781 | 0752 | 0724 | 0695 | 0667 | 22 |
| 23 | 0988 | 0958 | 0928 | 0898 | 0868 | 0839 | 0810 | 0781 | 0752 | 0723 | 0695 | 0667 | 23 |
| 24 | 0987 | 0957 | 0927 | 0897 | 0868 | 0838 | 0809 | 0780 | 0751 | 0723 | 0694 | 0666 | 24 |
| 25 | 0987 | 0957 | 0927 | 0897 | 0867 | 0838 | 0809 | 0780 | 0751 | 0722 | 0694 | 0666 | 25 |
| 26 | 0986 | 0956 | 0926 | 0896 | 0867 | 0837 | 0808 | 0779 | 0750 | 0722 | 0693 | 0665 | 26 |
| 27 | 0986 | 0956 | 0926 | 0896 | 0866 | 0837 | 0808 | 0779 | 0750 | 0721 | 0693 | 0665 | 27 |
| 28 | 0985 | 0955 | 0925 | 0895 | 0866 | 0836 | 0807 | 0778 | 0750 | 0721 | 0693 | 0664 | 28 |
| 29 | 0985 | 0955 | 0925 | 0895 | 0865 | 0836 | 0807 | 0778 | 0749 | 0720 | 0692 | 0664 | 29 |
| 30 | 0984 | 0954 | 0924 | 0894 | 0865 | 0835 | 0806 | 0777 | 0749 | 0720 | 0692 | 0663 | 30 |
| 31 | 0984 | 0954 | 0924 | 0894 | 0864 | 0835 | 0806 | 0777 | 0748 | 0720 | 0691 | 0663 | 31 |
| 32 | 0983 | 0953 | 0923 | 0893 | 0864 | 0834 | 0805 | 0776 | 0748 | 0719 | 0691 | 0662 | 32 |
| 33 | 0983 | 0953 | 0923 | 0893 | 0863 | 0834 | 0805 | 0776 | 0747 | 0719 | 0690 | 0662 | 33 |
| 34 | 0982 | 0952 | 0922 | 0892 | 0863 | 0833 | 0804 | 0775 | 0747 | 0718 | 0690 | 0662 | 34 |
| 35 | 0982 | 0952 | 0922 | 0892 | 0862 | 0833 | 0804 | 0775 | 0746 | 0718 | 0689 | 0661 | 35 |
| 36 | 0981 | 0951 | 0921 | 0891 | 0862 | 0833 | 0803 | 0774 | 0746 | 0717 | 0689 | 0661 | 36 |
| 37 | 0981 | 0951 | 0921 | 0891 | 0861 | 0832 | 0803 | 0774 | 0745 | 0717 | 0688 | 0660 | 37 |
| 38 | 0980 | 0950 | 0920 | 0890 | 0861 | 0832 | 0802 | 0773 | 0745 | 0716 | 0688 | 0660 | 38 |
| 39 | 0980 | 0950 | 0920 | 0890 | 0860 | 0831 | 0802 | 0773 | 0744 | 0716 | 0687 | 0659 | 39 |
| 40 | 0979 | 0949 | 0919 | 0889 | 0860 | 0831 | 0801 | 0773 | 0744 | 0715 | 0687 | 0659 | 40 |
| 41 | 0979 | 0949 | 0919 | 0889 | 0859 | 0830 | 0801 | 0772 | 0743 | 0715 | 0686 | 0658 | 41 |
| 42 | 0978 | 0948 | 0918 | 0888 | 0859 | 0830 | 0801 | 0772 | 0743 | 0714 | 0686 | 0658 | 42 |
| 43 | 0978 | 0948 | 0918 | 0888 | 0858 | 0829 | 0800 | 0771 | 0742 | 0714 | 0685 | 0657 | 43 |
| 44 | 0977 | 0947 | 0917 | 0887 | 0858 | 0829 | 0800 | 0771 | 0742 | 0713 | 0685 | 0657 | 44 |
| 45 | 0977 | 0947 | 0917 | 0887 | 0857 | 0828 | 0799 | 0770 | 0741 | 0713 | 0685 | 0656 | 45 |
| 46 | 0976 | 0946 | 0916 | 0886 | 0857 | 0828 | 0799 | 0770 | 0741 | 0712 | 0684 | 0656 | 46 |
| 47 | 0976 | 0946 | 0916 | 0886 | 0856 | 0827 | 0798 | 0769 | 0740 | 0712 | 0684 | 0655 | 47 |
| 48 | 0975 | 0945 | 0915 | 0885 | 0856 | 0827 | 0798 | 0769 | 0740 | 0711 | 0683 | 0655 | 48 |
| 49 | 0975 | 0945 | 0915 | 0885 | 0855 | 0826 | 0797 | 0768 | 0739 | 0711 | 0683 | 0655 | 49 |
| 50 | 0974 | 0944 | 0914 | 0884 | 0855 | 0826 | 0797 | 0768 | 0739 | 0711 | 0682 | 0654 | 50 |
| 51 | 0974 | 0944 | 0914 | 0884 | 0855 | 0825 | 0796 | 0767 | 0739 | 0710 | 0682 | 0654 | 51 |
| 52 | 0973 | 0943 | 0913 | 0883 | 0854 | 0825 | 0796 | 0767 | 0738 | 0710 | 0681 | 0653 | 52 |
| 53 | 0973 | 0943 | 0913 | 0883 | 0854 | 0824 | 0795 | 0766 | 0738 | 0709 | 0681 | 0653 | 53 |
| 54 | 0972 | 0942 | 0912 | 0882 | 0853 | 0824 | 0795 | 0766 | 0737 | 0709 | 0680 | 0652 | 54 |
| 55 | 0972 | 0942 | 0912 | 0882 | 0853 | 0823 | 0794 | 0765 | 0737 | 0708 | 0680 | 0652 | 55 |
| 56 | 0971 | 0941 | 0911 | 0881 | 0852 | 0823 | 0794 | 0765 | 0736 | 0708 | 0679 | 0651 | 56 |
| 57 | 0971 | 0941 | 0911 | 0881 | 0852 | 0822 | 0793 | 0764 | 0736 | 0707 | 0679 | 0651 | 57 |
| 58 | 0970 | 0940 | 0910 | 0880 | 0851 | 0822 | 0793 | 0764 | 0735 | 0707 | 0678 | 0650 | 58 |
| 59 | 0970 | 0940 | 0910 | 0880 | 0851 | 0821 | 0792 | 0763 | 0735 | 0706 | 0678 | 0650 | 59 |
| 60 | 0969 | 0939 | 0909 | 0880 | 0850 | 0821 | 0792 | 0763 | 0734 | 0706 | 0678 | 0649 | 60 |

TABLE XXVII.—(*continued*).

**PROPORTIONAL LOGARITHMS**

| sec. ″ | h m 2° 35′ | h m 2° 36′ | h m 2° 37′ | h m 2° 38′ | h m 2° 39′ | h m 2° 40′ | h m 2° 41′ | h m 2° 42′ | h m 2° 43′ | h m 2° 44′ | h m 2° 45′ | h m 2° 46′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0649 | 0621 | 0594 | 0566 | 0539 | 0512 | 0484 | 0458 | 0431 | 0404 | 0378 | 0352 | 0 |
| 1 | 0649 | 0621 | 0593 | 0566 | 0538 | 0511 | 0484 | 0457 | 0430 | 0404 | 0377 | 0351 | 1 |
| 2 | 0648 | 0621 | 0593 | 0565 | 0538 | 0511 | 0484 | 0457 | 0430 | 0403 | 0377 | 0351 | 2 |
| 3 | 0648 | 0620 | 0592 | 0565 | 0537 | 0510 | 0483 | 0456 | 0430 | 0403 | 0377 | 0350 | 3 |
| 4 | 0648 | 0620 | 0592 | 0564 | 0537 | 0510 | 0483 | 0456 | 0429 | 0402 | 0376 | 0350 | 4 |
| 5 | 0647 | 0619 | 0591 | 0564 | 0536 | 0509 | 0482 | 0455 | 0429 | 0402 | 0376 | 0349 | 5 |
| 6 | 0647 | 0619 | 0591 | 0563 | 0536 | 0509 | 0482 | 0455 | 0428 | 0402 | 0375 | 0349 | 6 |
| 7 | 0646 | 0618 | 0590 | 0563 | 0536 | 0508 | 0481 | 0454 | 0428 | 0401 | 0375 | 0349 | 7 |
| 8 | 0646 | 0618 | 0590 | 0562 | 0535 | 0508 | 0481 | 0454 | 0427 | 0401 | 0374 | 0348 | 8 |
| 9 | 0645 | 0617 | 0590 | 0562 | 0535 | 0507 | 0480 | 0454 | 0427 | 0400 | 0374 | 0348 | 9 |
| 10 | 0645 | 0617 | 0589 | 0562 | 0534 | 0507 | 0480 | 0453 | 0426 | 0400 | 0373 | 0347 | 10 |
| 11 | 0644 | 0616 | 0589 | 0561 | 0534 | 0507 | 0479 | 0453 | 0426 | 0399 | 0373 | 0347 | 11 |
| 12 | 0644 | 0616 | 0588 | 0561 | 0533 | 0506 | 0479 | 0452 | 0426 | 0399 | 0373 | 0346 | 12 |
| 13 | 0643 | 0615 | 0588 | 0560 | 0533 | 0506 | 0479 | 0452 | 0425 | 0399 | 0372 | 0346 | 13 |
| 14 | 0643 | 0615 | 0587 | 0560 | 0532 | 0505 | 0478 | 0451 | 0425 | 0398 | 0372 | 0346 | 14 |
| 15 | 0642 | 0615 | 0587 | 0559 | 0532 | 0505 | 0478 | 0451 | 0424 | 0398 | 0371 | 0345 | 15 |
| 16 | 0642 | 0614 | 0586 | 0559 | 0531 | 0504 | 0477 | 0450 | 0424 | 0397 | 0371 | 0345 | 16 |
| 17 | 0641 | 0614 | 0586 | 0558 | 0531 | 0504 | 0477 | 0450 | 0423 | 0397 | 0370 | 0344 | 17 |
| 18 | 0641 | 0613 | 0585 | 0558 | 0531 | 0503 | 0476 | 0450 | 0423 | 0396 | 0370 | 0344 | 18 |
| 19 | 0641 | 0613 | 0585 | 0557 | 0530 | 0503 | 0476 | 0449 | 0422 | 0396 | 0370 | 0343 | 19 |
| 20 | 0640 | 0612 | 0584 | 0557 | 0530 | 0502 | 0475 | 0449 | 0422 | 0395 | 0369 | 0343 | 20 |
| 21 | 0640 | 0612 | 0584 | 0557 | 0529 | 0502 | 0475 | 0448 | 0422 | 0395 | 0369 | 0342 | 21 |
| 22 | 0639 | 0611 | 0584 | 0556 | 0529 | 0502 | 0475 | 0448 | 0421 | 0395 | 0368 | 0342 | 22 |
| 23 | 0639 | 0611 | 0583 | 0556 | 0528 | 0501 | 0474 | 0447 | 0421 | 0394 | 0368 | 0342 | 23 |
| 24 | 0638 | 0610 | 0583 | 0555 | 0528 | 0501 | 0474 | 0447 | 0420 | 0394 | 0367 | 0341 | 24 |
| 25 | 0638 | 0610 | 0582 | 0555 | 0527 | 0500 | 0473 | 0446 | 0420 | 0393 | 0367 | 0341 | 25 |
| 26 | 0637 | 0609 | 0582 | 0554 | 0527 | 0500 | 0473 | 0446 | 0419 | 0393 | 0366 | 0340 | 26 |
| 27 | 0637 | 0609 | 0581 | 0554 | 0526 | 0499 | 0472 | 0446 | 0419 | 0392 | 0366 | 0340 | 27 |
| 28 | 0636 | 0608 | 0581 | 0553 | 0526 | 0499 | 0472 | 0445 | 0418 | 0392 | 0366 | 0339 | 28 |
| 29 | 0636 | 0608 | 0580 | 0553 | 0526 | 0498 | 0471 | 0445 | 0418 | 0391 | 0365 | 0339 | 29 |
| 30 | 0635 | 0608 | 0580 | 0552 | 0525 | 0498 | 0471 | 0444 | 0418 | 0391 | 0365 | 0339 | 30 |
| 31 | 0635 | 0607 | 0579 | 0552 | 0525 | 0497 | 0471 | 0444 | 0417 | 0391 | 0364 | 0338 | 31 |
| 32 | 0634 | 0607 | 0579 | 0551 | 0524 | 0497 | 0470 | 0443 | 0417 | 0390 | 0364 | 0338 | 32 |
| 33 | 0634 | 0606 | 0579 | 0551 | 0524 | 0497 | 0470 | 0443 | 0416 | 0390 | 0363 | 0337 | 33 |
| 34 | 0634 | 0606 | 0578 | 0551 | 0523 | 0496 | 0469 | 0442 | 0416 | 0389 | 0363 | 0337 | 34 |
| 35 | 0633 | 0605 | 0578 | 0550 | 0523 | 0496 | 0469 | 0442 | 0415 | 0389 | 0363 | 0336 | 35 |
| 36 | 0633 | 0605 | 0577 | 0550 | 0522 | 0495 | 0468 | 0442 | 0415 | 0388 | 0362 | 0336 | 36 |
| 37 | 0632 | 0604 | 0577 | 0549 | 0522 | 0495 | 0468 | 0441 | 0414 | 0388 | 0362 | 0336 | 37 |
| 38 | 0632 | 0604 | 0576 | 0549 | 0521 | 0494 | 0467 | 0441 | 0414 | 0388 | 0361 | 0335 | 38 |
| 39 | 0631 | 0603 | 0576 | 0548 | 0521 | 0494 | 0467 | 0440 | 0414 | 0387 | 0361 | 0335 | 39 |
| 40 | 0631 | 0603 | 0575 | 0548 | 0521 | 0493 | 0466 | 0440 | 0413 | 0387 | 0360 | 0334 | 40 |
| 41 | 0630 | 0602 | 0575 | 0547 | 0520 | 0493 | 0466 | 0439 | 0413 | 0386 | 0360 | 0334 | 41 |
| 42 | 0630 | 0602 | 0574 | 0547 | 0520 | 0493 | 0466 | 0439 | 0412 | 0386 | 0359 | 0333 | 42 |
| 43 | 0629 | 0602 | 0574 | 0546 | 0519 | 0492 | 0465 | 0438 | 0412 | 0385 | 0359 | 0333 | 43 |
| 44 | 0629 | 0601 | 0573 | 0546 | 0519 | 0492 | 0465 | 0438 | 0411 | 0385 | 0359 | 0332 | 44 |
| 45 | 0628 | 0601 | 0573 | 0546 | 0518 | 0491 | 0464 | 0438 | 0411 | 0384 | 0358 | 0332 | 45 |
| 46 | 0628 | 0600 | 0573 | 0545 | 0518 | 0491 | 0464 | 0437 | 0410 | 0384 | 0358 | 0332 | 46 |
| 47 | 0627 | 0600 | 0572 | 0545 | 0517 | 0490 | 0463 | 0437 | 0410 | 0384 | 0357 | 0331 | 47 |
| 48 | 0627 | 0599 | 0572 | 0544 | 0517 | 0490 | 0463 | 0436 | 0410 | 0383 | 0357 | 0331 | 48 |
| 49 | 0627 | 0599 | 0571 | 0544 | 0516 | 0489 | 0462 | 0436 | 0409 | 0383 | 0356 | 0330 | 49 |
| 50 | 0626 | 0598 | 0571 | 0543 | 0516 | 0489 | 0462 | 0435 | 0409 | 0382 | 0356 | 0330 | 50 |
| 51 | 0626 | 0598 | 0570 | 0543 | 0516 | 0489 | 0462 | 0435 | 0408 | 0382 | 0356 | 0329 | 51 |
| 52 | 0625 | 0597 | 0570 | 0542 | 0515 | 0488 | 0461 | 0434 | 0408 | 0381 | 0355 | 0329 | 52 |
| 53 | 0625 | 0597 | 0569 | 0542 | 0515 | 0488 | 0461 | 0434 | 0407 | 0381 | 0355 | 0329 | 53 |
| 54 | 0624 | 0596 | 0569 | 0541 | 0514 | 0487 | 0460 | 0434 | 0407 | 0381 | 0354 | 0328 | 54 |
| 55 | 0624 | 0596 | 0568 | 0541 | 0514 | 0487 | 0460 | 0433 | 0406 | 0380 | 0354 | 0328 | 55 |
| 56 | 0623 | 0596 | 0568 | 0541 | 0513 | 0486 | 0459 | 0433 | 0406 | 0380 | 0353 | 0327 | 56 |
| 57 | 0623 | 0595 | 0568 | 0540 | 0513 | 0486 | 0459 | 0432 | 0406 | 0379 | 0353 | 0327 | 57 |
| 58 | 0622 | 0595 | 0567 | 0540 | 0512 | 0485 | 0458 | 0432 | 0405 | 0379 | 0352 | 0326 | 58 |
| 59 | 0622 | 0594 | 0567 | 0539 | 0512 | 0485 | 0458 | 0431 | 0405 | 0378 | 0352 | 0326 | 59 |
| 60 | 0621 | 0594 | 0566 | 0539 | 0512 | 0484 | 0458 | 0431 | 0404 | 0378 | 0352 | 0326 | 60 |

TABLE XXVII.—(*continued*).

**PROPORTIONAL LOGARITHMS**

| sec. ″ | h m 2° 47′ | h m 2° 48′ | h m 2° 49′ | h m 2° 50′ | h m 2° 51′ | h m 2° 52′ | h m 2° 53′ | h m 2° 54′ | h m 2° 55′ | h m 2° 56′ | h m 2° 57′ | h m 2° 58′ | h m 2° 59′ | sec. ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0326 | 0300 | 0274 | 0248 | 0223 | 0197 | 0172 | 0147 | 0122 | 0098 | 0073 | 0049 | 0024 | 0 |
| 1 | 0325 | 0299 | 0273 | 0248 | 0222 | 0197 | 0172 | 0147 | 0122 | 0097 | 0073 | 0048 | 0024 | 1 |
| 2 | 0325 | 0299 | 0273 | 0247 | 0222 | 0197 | 0171 | 0146 | 0121 | 0097 | 0072 | 0048 | 0023 | 2 |
| 3 | 0324 | 0298 | 0273 | 0247 | 0221 | 0196 | 0171 | 0146 | 0121 | 0096 | 0072 | 0047 | 0023 | 3 |
| 4 | 0324 | 0298 | 0272 | 0246 | 0221 | 0196 | 0171 | 0146 | 0121 | 0096 | 0071 | 0047 | 0023 | 4 |
| 5 | 0323 | 0297 | 0272 | 0246 | 0221 | 0195 | 0170 | 0145 | 0120 | 0096 | 0071 | 0046 | 0022 | 5 |
| 6 | 0323 | 0297 | 0271 | 0246 | 0220 | 0195 | 0170 | 0145 | 0120 | 0095 | 0071 | 0046 | 0022 | 6 |
| 7 | 0322 | 0297 | 0271 | 0245 | 0220 | 0194 | 0169 | 0144 | 0119 | 0095 | 0070 | 0046 | 0021 | 7 |
| 8 | 0322 | 0296 | 0270 | 0245 | 0219 | 0194 | 0169 | 0144 | 0119 | 0094 | 0070 | 0045 | 0021 | 8 |
| 9 | 0322 | 0296 | 0270 | 0244 | 0219 | 0194 | 0169 | 0143 | 0119 | 0094 | 0069 | 0045 | 0021 | 9 |
| 10 | 0321 | 0295 | 0270 | 0244 | 0218 | 0193 | 0168 | 0143 | 0118 | 0093 | 0069 | 0044 | 0020 | 10 |
| 11 | 0321 | 0295 | 0269 | 0244 | 0218 | 0193 | 0168 | 0143 | 0118 | 0093 | 0068 | 0044 | 0020 | 11 |
| 12 | 0320 | 0294 | 0269 | 0243 | 0218 | 0192 | 0167 | 0142 | 0117 | 0093 | 0068 | 0044 | 0019 | 12 |
| 13 | 0320 | 0294 | 0268 | 0243 | 0217 | 0192 | 0167 | 0142 | 0117 | 0092 | 0068 | 0043 | 0019 | 13 |
| 14 | 0319 | 0294 | 0268 | 0242 | 0217 | 0192 | 0166 | 0141 | 0117 | 0092 | 0067 | 0043 | 0018 | 14 |
| 15 | 0319 | 0293 | 0267 | 0242 | 0216 | 0191 | 0166 | 0141 | 0116 | 0091 | 0067 | 0042 | 0018 | 15 |
| 16 | 0319 | 0293 | 0267 | 0241 | 0216 | 0191 | 0166 | 0141 | 0116 | 0091 | 0066 | 0042 | 0018 | 16 |
| 17 | 0318 | 0292 | 0267 | 0241 | 0216 | 0190 | 0165 | 0140 | 0115 | 0091 | 0066 | 0042 | 0017 | 17 |
| 18 | 0318 | 0292 | 0266 | 0241 | 0215 | 0190 | 0165 | 0140 | 0115 | 0090 | 0066 | 0041 | 0017 | 18 |
| 19 | 0317 | 0291 | 0266 | 0240 | 0215 | 0189 | 0164 | 0139 | 0114 | 0090 | 0065 | 0041 | 0016 | 19 |
| 20 | 0317 | 0291 | 0265 | 0240 | 0214 | 0189 | 0164 | 0139 | 0114 | 0089 | 0065 | 0040 | 0016 | 20 |
| 21 | 0316 | 0291 | 0265 | 0239 | 0214 | 0189 | 0163 | 0139 | 0114 | 0089 | 0064 | 0040 | 0016 | 21 |
| 22 | 0316 | 0290 | 0264 | 0239 | 0213 | 0188 | 0163 | 0138 | 0113 | 0089 | 0064 | 0040 | 0015 | 22 |
| 23 | 0316 | 0290 | 0264 | 0238 | 0213 | 0188 | 0163 | 0138 | 0113 | 0088 | 0064 | 0039 | 0015 | 23 |
| 24 | 0315 | 0289 | 0264 | 0238 | 0213 | 0187 | 0162 | 0137 | 0112 | 0088 | 0063 | 0039 | 0015 | 24 |
| 25 | 0315 | 0289 | 0263 | 0238 | 0212 | 0187 | 0162 | 0137 | 0112 | 0087 | 0063 | 0038 | 0014 | 25 |
| 26 | 0314 | 0288 | 0263 | 0237 | 0212 | 0186 | 0161 | 0136 | 0112 | 0087 | 0062 | 0038 | 0014 | 26 |
| 27 | 0314 | 0288 | 0262 | 0237 | 0211 | 0186 | 0161 | 0136 | 0111 | 0087 | 0062 | 0038 | 0013 | 27 |
| 28 | 0313 | 0288 | 0262 | 0236 | 0211 | 0186 | 0161 | 0136 | 0111 | 0086 | 0062 | 0037 | 0013 | 28 |
| 29 | 0313 | 0287 | 0261 | 0236 | 0210 | 0185 | 0160 | 0135 | 0110 | 0086 | 0061 | 0037 | 0012 | 29 |
| 30 | 0313 | 0287 | 0261 | 0235 | 0210 | 0185 | 0160 | 0135 | 0110 | 0085 | 0061 | 0036 | 0012 | 30 |
| 31 | 0312 | 0286 | 0261 | 0235 | 0210 | 0184 | 0159 | 0134 | 0110 | 0085 | 0060 | 0036 | 0012 | 31 |
| 32 | 0312 | 0286 | 0260 | 0235 | 0209 | 0184 | 0159 | 0134 | 0109 | 0084 | 0060 | 0035 | 0011 | 32 |
| 33 | 0311 | 0285 | 0260 | 0234 | 0209 | 0184 | 0158 | 0134 | 0109 | 0084 | 0060 | 0035 | 0011 | 33 |
| 34 | 0311 | 0285 | 0259 | 0234 | 0208 | 0183 | 0158 | 0133 | 0108 | 0084 | 0059 | 0035 | 0010 | 34 |
| 35 | 0310 | 0285 | 0259 | 0233 | 0208 | 0183 | 0158 | 0133 | 0108 | 0083 | 0059 | 0034 | 0010 | 35 |
| 36 | 0310 | 0284 | 0258 | 0233 | 0208 | 0182 | 0157 | 0132 | 0107 | 0083 | 0058 | 0034 | 0010 | 36 |
| 37 | 0310 | 0284 | 0258 | 0232 | 0207 | 0182 | 0157 | 0132 | 0107 | 0082 | 0058 | 0033 | 0009 | 37 |
| 38 | 0309 | 0283 | 0258 | 0232 | 0207 | 0181 | 0156 | 0131 | 0107 | 0082 | 0057 | 0033 | 0009 | 38 |
| 39 | 0309 | 0283 | 0257 | 0232 | 0206 | 0181 | 0156 | 0131 | 0106 | 0082 | 0057 | 0033 | 0008 | 39 |
| 40 | 0308 | 0282 | 0257 | 0231 | 0206 | 0181 | 0156 | 0131 | 0106 | 0081 | 0057 | 0032 | 0008 | 40 |
| 41 | 0308 | 0282 | 0256 | 0231 | 0205 | 0180 | 0155 | 0130 | 0105 | 0081 | 0056 | 0032 | 0008 | 41 |
| 42 | 0307 | 0282 | 0256 | 0230 | 0205 | 0180 | 0155 | 0130 | 0105 | 0080 | 0056 | 0031 | 0007 | 42 |
| 43 | 0307 | 0281 | 0255 | 0230 | 0205 | 0179 | 0154 | 0129 | 0105 | 0080 | 0055 | 0031 | 0007 | 43 |
| 44 | 0306 | 0281 | 0255 | 0230 | 0204 | 0179 | 0154 | 0129 | 0104 | 0080 | 0055 | 0031 | 0006 | 44 |
| 45 | 0306 | 0280 | 0255 | 0229 | 0204 | 0179 | 0153 | 0129 | 0104 | 0079 | 0055 | 0030 | 0006 | 45 |
| 46 | 0306 | 0280 | 0254 | 0229 | 0203 | 0178 | 0153 | 0128 | 0103 | 0079 | 0054 | 0030 | 0006 | 46 |
| 47 | 0305 | 0279 | 0254 | 0228 | 0203 | 0178 | 0153 | 0128 | 0103 | 0078 | 0054 | 0029 | 0005 | 47 |
| 48 | 0305 | 0279 | 0253 | 0228 | 0202 | 0177 | 0152 | 0127 | 0103 | 0078 | 0053 | 0029 | 0005 | 48 |
| 49 | 0304 | 0279 | 0253 | 0227 | 0202 | 0177 | 0152 | 0127 | 0102 | 0077 | 0053 | 0029 | 0004 | 49 |
| 50 | 0304 | 0278 | 0252 | 0227 | 0202 | 0176 | 0151 | 0126 | 0102 | 0077 | 0053 | 0028 | 0004 | 50 |
| 51 | 0304 | 0278 | 0252 | 0227 | 0201 | 0176 | 0151 | 0126 | 0101 | 0077 | 0052 | 0028 | 0004 | 51 |
| 52 | 0303 | 0277 | 0252 | 0226 | 0201 | 0176 | 0151 | 0126 | 0101 | 0076 | 0052 | 0027 | 0003 | 52 |
| 53 | 0303 | 0277 | 0251 | 0226 | 0200 | 0175 | 0150 | 0125 | 0100 | 0076 | 0051 | 0027 | 0003 | 53 |
| 54 | 0392 | 0276 | 0251 | 0225 | 0200 | 0175 | 0150 | 0125 | 0100 | 0075 | 0051 | 0027 | 0002 | 54 |
| 55 | 0302 | 0276 | 0250 | 0225 | 0200 | 0174 | 0149 | 0124 | 0100 | 0075 | 0051 | 0026 | 0002 | 55 |
| 56 | 0301 | 0276 | 0250 | 0224 | 0199 | 0174 | 0149 | 0124 | 0099 | 0075 | 0050 | 0026 | 0002 | 56 |
| 57 | 0301 | 0275 | 0250 | 0224 | 0199 | 0174 | 0148 | 0124 | 0099 | 0074 | 0050 | 0025 | 0001 | 57 |
| 58 | 0300 | 0275 | 0249 | 0224 | 0198 | 0173 | 0148 | 0123 | 0098 | 0074 | 0049 | 0025 | 0001 | 58 |
| 59 | 0300 | 0274 | 0249 | 0223 | 0198 | 0173 | 0148 | 0123 | 0098 | 0073 | 0049 | 0025 | 0000 | 59 |
| 60 | 0300 | 0274 | 0248 | 0223 | 0197 | 0172 | 0147 | 0122 | 0098 | 0073 | 0049 | 0024 | 0000 | 60 |

## TABLE XXVIII.

| ′ ″ | 0° Co-sine. | 0° Parts for ″ | 1° Co-sine. | 1° Parts for ″ | 2° Co-sine. | 2° Parts for ″ | 3° Co-sine. | 3° Parts for ″ | 4° Co-sine. | 4° Parts for ″ | 5° Co-sine. | 5° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 000000 | 0 | 999848 | 0 | 999391 | 0 | 998630 | 0 | 997564 | 0 | 996195 | 0 |
| 1 | 00 | 0 | 843 | 0 | 381 | 0 | 614 | 0 | 544 | 0 | 6169 | 0 |
| 2 | 00 | 0 | 837 | 0 | 370 | 0 | 599 | 1 | 523 | 1 | 6144 | 1 |
| 3 | 00 | 0 | 832 | 0 | 360 | 1 | 584 | 1 | 503 | 1 | 6118 | 1 |
| 4 | 999999 | 0 | 827 | 0 | 350 | 1 | 568 | 1 | 482 | 1 | 6093 | 2 |
| 5 | 99 | 0 | 821 | 0 | 339 | 1 | 552 | 1 | 462 | 2 | 6067 | 2 |
| 6 | 99 | 0 | 816 | 1 | 328 | 1 | 537 | 2 | 441 | 2 | 6041 | 3 |
| 7 | 98 | 0 | 810 | 1 | 318 | 1 | 521 | 2 | 420 | 3 | 6015 | 3 |
| 8 | 97 | 1 | 804 | 1 | 307 | 1 | 505 | 2 | 399 | 3 | 5989 | 3 |
| 9 | 97 | 1 | 799 | 1 | 296 | 2 | 489 | 2 | 378 | 3 | 5963 | 4 |
| 10 | 96 | 1 | 793 | 1 | 285 | 2 | 473 | 3 | 357 | 4 | 5937 | 4 |
| 11 | 999995 | 1 | 999787 | 1 | 999274 | 2 | 998457 | 3 | 997336 | 4 | 995911 | 5 |
| 12 | 94 | 1 | 781 | 1 | 263 | 2 | 441 | 3 | 315 | 4 | 884 | 5 |
| 13 | 93 | 1 | 774 | 1 | 252 | 2 | 425 | 4 | 293 | 5 | 858 | 6 |
| 14 | 92 | 1 | 768 | 1 | 240 | 3 | 408 | 4 | 272 | 5 | 832 | 6 |
| 15 | 91 | 1 | 762 | 2 | 229 | 3 | 392 | 4 | 250 | 5 | 805 | 7 |
| 16 | 89 | 1 | 756 | 2 | 218 | 3 | 375 | 4 | 229 | 6 | 778 | 7 |
| 17 | 88 | 1 | 749 | 2 | 206 | 3 | 359 | 4 | 207 | 6 | 752 | 7 |
| 18 | 86 | 1 | 743 | 2 | 194 | 3 | 342 | 5 | 185 | 6 | 725 | 8 |
| 19 | 85 | 1 | 736 | 2 | 183 | 4 | 325 | 5 | 163 | 7 | 698 | 8 |
| 20 | 83 | 1 | 729 | 2 | 171 | 4 | 308 | 5 | 141 | 7 | 671 | 9 |
| 21 | 999981 | 1 | 999722 | 2 | 999159 | 4 | 998291 | 6 | 997119 | 7 | 995644 | 9 |
| 22 | 80 | 2 | 716 | 2 | 147 | 4 | 274 | 6 | 7097 | 8 | 617 | 10 |
| 23 | 78 | 2 | 709 | 2 | 135 | 4 | 257 | 6 | 7075 | 8 | 589 | 10 |
| 24 | 76 | 2 | 701 | 3 | 123 | 5 | 240 | 7 | 7053 | 8 | 562 | 11 |
| 25 | 74 | 2 | 694 | 3 | 111 | 5 | 223 | 7 | 7030 | 9 | 535 | 11 |
| 26 | 71 | 2 | 687 | 3 | 098 | 5 | 205 | 7 | 7008 | 9 | 507 | 11 |
| 27 | 69 | 2 | 680 | 3 | 086 | 5 | 188 | 8 | 6985 | 10 | 480 | 12 |
| 28 | 67 | 2 | 672 | 3 | 073 | 5 | 170 | 8 | 6963 | 10 | 452 | 12 |
| 29 | 64 | 2 | 665 | 3 | 061 | 6 | 153 | 8 | 6940 | 11 | 424 | 13 |
| 30 | 62 | 2 | 657 | 3 | 048 | 6 | 135 | 9 | 6917 | 11 | 396 | 14 |
| 31 | 999959 | 2 | 999650 | 4 | 999036 | 7 | 998117 | 9 | 996895 | 12 | 995368 | 15 |
| 32 | 57 | 2 | 642 | 4 | 9023 | 7 | 8099 | 10 | 872 | 13 | 340 | 15 |
| 33 | 54 | 2 | 634 | 4 | 9010 | 7 | 8081 | 10 | 849 | 13 | 312 | 16 |
| 34 | 51 | 2 | 626 | 4 | 8997 | 8 | 8063 | 11 | 825 | 14 | 284 | 16 |
| 35 | 48 | 2 | 618 | 4 | 8984 | 8 | 8045 | 11 | 802 | 14 | 256 | 17 |
| 36 | 45 | 2 | 610 | 5 | 8971 | 8 | 8027 | 11 | 779 | 15 | 227 | 18 |
| 37 | 42 | 2 | 602 | 5 | 8957 | 9 | 8008 | 12 | 756 | 15 | 199 | 18 |
| 38 | 39 | 2 | 594 | 5 | 8944 | 9 | 7990 | 12 | 732 | 16 | 171 | 19 |
| 39 | 36 | 2 | 585 | 5 | 8931 | 9 | 7972 | 12 | 709 | 16 | 142 | 19 |
| 40 | 32 | 2 | 577 | 6 | 8917 | 9 | 7953 | 13 | 685 | 16 | 113 | 20 |
| 41 | 999929 | 2 | 999568 | 6 | 998904 | 10 | 997934 | 13 | 996661 | 17 | 995084 | 20 |
| 42 | 925 | 2 | 560 | 6 | 890 | 10 | 916 | 13 | 637 | 17 | 5056 | 21 |
| 43 | 922 | 2 | 551 | 6 | 876 | 10 | 897 | 14 | 614 | 17 | 5027 | 21 |
| 44 | 918 | 2 | 542 | 6 | 862 | 10 | 878 | 14 | 590 | 18 | 4998 | 21 |
| 45 | 914 | 3 | 534 | 6 | 848 | 11 | 859 | 14 | 566 | 18 | 4969 | 22 |
| 46 | 911 | 3 | 525 | 6 | 834 | 11 | 840 | 15 | 541 | 19 | 4939 | 22 |
| 47 | 907 | 3 | 516 | 7 | 820 | 11 | 821 | 15 | 517 | 19 | 4910 | 23 |
| 48 | 903 | 3 | 507 | 7 | 806 | 11 | 802 | 15 | 493 | 20 | 4881 | 23 |
| 49 | 898 | 3 | 497 | 7 | 792 | 11 | 782 | 16 | 469 | 20 | 4851 | 24 |
| 50 | 894 | 3 | 488 | 7 | 778 | 12 | 763 | 16 | 444 | 20 | 4822 | 25 |
| 51 | 999890 | 3 | 999479 | 7 | 998763 | 12 | 997743 | 16 | 996420 | 21 | 994792 | 25 |
| 52 | 886 | 3 | 469 | 7 | 749 | 12 | 724 | 16 | 395 | 21 | 763 | 26 |
| 53 | 881 | 3 | 460 | 7 | 734 | 12 | 704 | 17 | 370 | 22 | 733 | 26 |
| 54 | 877 | 3 | 450 | 8 | 719 | 13 | 684 | 17 | 345 | 22 | 703 | 27 |
| 55 | 872 | 3 | 441 | 8 | 705 | 13 | 665 | 17 | 320 | 22 | 673 | 27 |
| 56 | 867 | 3 | 431 | 8 | 690 | 13 | 645 | 18 | 295 | 23 | 643 | 28 |
| 57 | 863 | 3 | 421 | 8 | 675 | 14 | 625 | 18 | 270 | 23 | 613 | 28 |
| 58 | 858 | 3 | 411 | 8 | 660 | 14 | 605 | 18 | 245 | 24 | 583 | 29 |
| 59 | 853 | 3 | 401 | 8 | 645 | 14 | 584 | 19 | 220 | 24 | 552 | 29 |
| 60 | 848 | 4 | 391 | 9 | 630 | 14 | 564 | 19 | 195 | 24 | 522 | 29 |

TABLE XXVIII.—(*continued*).

| ′ | 6° | | 7° | | 8° | | 9° | | 10° | | 11° | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ |
| 0 | 994522 | 0 | 992546 | 0 | 990268 | 0 | 987688 | 0 | 984808 | 0 | 981627 | 0 |
| 1 | 491 | 1 | 511 | 1 | 0228 | 1 | 643 | 1 | 757 | 1 | 572 | 1 |
| 2 | 461 | 1 | 475 | 1 | 0187 | 1 | 597 | 1 | 707 | 2 | 516 | 2 |
| 3 | 430 | 2 | 439 | 2 | 0146 | 2 | 551 | 2 | 656 | 3 | 460 | 3 |
| 4 | 400 | 2 | 404 | 2 | 0106 | 3 | 506 | 3 | 605 | 3 | 405 | 4 |
| 5 | 369 | 3 | 368 | 3 | 0065 | 3 | 460 | 4 | 554 | 4 | 349 | 5 |
| 6 | 338 | 3 | 332 | 4 | 0024 | 4 | 414 | 5 | 503 | 5 | 293 | 6 |
| 7 | 307 | 4 | 296 | 4 | 989983 | 5 | 368 | 6 | 452 | 6 | 237 | 7 |
| 8 | 276 | 4 | 260 | 5 | 9942 | 6 | 322 | 7 | 401 | 7 | 181 | 7 |
| 9 | 245 | 5 | 224 | 6 | 9900 | 6 | 275 | 8 | 350 | 8 | 124 | 8 |
| 10 | 214 | 5 | 187 | 6 | 9859 | 7 | 229 | 8 | 299 | 9 | 068 | 9 |
| 11 | 994182 | 6 | 992151 | 7 | 989818 | 8 | 987183 | 9 | 984247 | 9 | 981012 | 10 |
| 12 | 4151 | 6 | 2115 | 7 | 776 | 8 | 7136 | 10 | 4196 | 10 | 0955 | 11 |
| 13 | 4120 | 7 | 2078 | 8 | 735 | 9 | 7090 | 11 | 4144 | 11 | 0899 | 12 |
| 14 | 4088 | 7 | 2042 | 9 | 693 | 10 | 7043 | 12 | 4092 | 12 | 0842 | 13 |
| 15 | 4056 | 8 | 2005 | 9 | 651 | 10 | 6996 | 12 | 4041 | 13 | 0785 | 14 |
| 16 | 4025 | 8 | 1968 | 10 | 610 | 11 | 6950 | 13 | 3989 | 14 | 0729 | 15 |
| 17 | 3993 | 9 | 1931 | 10 | 568 | 12 | 6903 | 13 | 3937 | 15 | 0672 | 16 |
| 18 | 3961 | 9 | 1894 | 11 | 526 | 12 | 6856 | 14 | 3885 | 16 | 0615 | 17 |
| 19 | 3929 | 10 | 1857 | 12 | 484 | 13 | 6809 | 15 | 3833 | 16 | 0558 | 18 |
| 20 | 3897 | 10 | 1820 | 12 | 442 | 14 | 6762 | 15 | 3781 | 17 | 0501 | 19 |
| 21 | 993865 | 11 | 991783 | 13 | 989399 | 14 | 986714 | 16 | 983729 | 18 | 980443 | 20 |
| 22 | 833 | 11 | 746 | 13 | 357 | 15 | 667 | 17 | 676 | 19 | 0386 | 21 |
| 23 | 800 | 12 | 709 | 14 | 315 | 16 | 620 | 18 | 624 | 20 | 0329 | 22 |
| 24 | 768 | 13 | 671 | 15 | 272 | 17 | 572 | 19 | 572 | 21 | 0271 | 23 |
| 25 | 736 | 13 | 634 | 15 | 230 | 17 | 525 | 19 | 519 | 22 | 0214 | 24 |
| 26 | 703 | 14 | 596 | 16 | 187 | 18 | 477 | 20 | 466 | 22 | 0156 | 25 |
| 27 | 670 | 14 | 558 | 17 | 145 | 19 | 429 | 21 | 414 | 23 | 0098 | 26 |
| 28 | 638 | 15 | 521 | 17 | 102 | 19 | 382 | 22 | 361 | 24 | 0041 | 27 |
| 29 | 605 | 15 | 483 | 18 | 059 | 20 | 334 | 23 | 308 | 25 | 979983 | 28 |
| 30 | 572 | 16 | 445 | 19 | 016 | 21 | 286 | 24 | 255 | 26 | 9925 | 29 |
| 31 | 993539 | 17 | 991407 | 20 | 988973 | 22 | 986238 | 25 | 983202 | 27 | 979867 | 30 |
| 32 | 506 | 18 | 369 | 21 | 930 | 23 | 6189 | 26 | 3149 | 28 | 809 | 31 |
| 33 | 473 | 19 | 331 | 22 | 887 | 24 | 6141 | 27 | 3096 | 29 | 750 | 32 |
| 34 | 440 | 19 | 292 | 22 | 843 | 25 | 6093 | 28 | 3042 | 30 | 692 | 33 |
| 35 | 406 | 20 | 254 | 23 | 800 | 26 | 6045 | 29 | 2989 | 31 | 634 | 34 |
| 36 | 373 | 21 | 216 | 24 | 756 | 26 | 5996 | 30 | 2935 | 32 | 575 | 35 |
| 37 | 339 | 21 | 177 | 24 | 713 | 27 | 5948 | 31 | 2882 | 33 | 517 | 36 |
| 38 | 306 | 22 | 138 | 25 | 669 | 28 | 5899 | 32 | 2828 | 34 | 458 | 37 |
| 39 | 272 | 22 | 100 | 26 | 626 | 28 | 5850 | 33 | 2774 | 35 | 399 | 38 |
| 40 | 238 | 23 | 061 | 26 | 582 | 29 | 5801 | 33 | 2721 | 36 | 341 | 39 |
| 41 | 993205 | 23 | 991022 | 27 | 988538 | 30 | 985752 | 34 | 982667 | 37 | 979282 | 40 |
| 42 | 3171 | 24 | 983 | 28 | 494 | 31 | 704 | 35 | 613 | 38 | 9223 | 41 |
| 43 | 3137 | 24 | 944 | 28 | 450 | 32 | 654 | 35 | 559 | 39 | 9164 | 42 |
| 44 | 3103 | 25 | 905 | 29 | 406 | 32 | 605 | 36 | 505 | 40 | 9105 | 43 |
| 45 | 3069 | 25 | 866 | 30 | 362 | 33 | 556 | 37 | 450 | 41 | 9046 | 44 |
| 46 | 3034 | 26 | 827 | 30 | 317 | 34 | 507 | 38 | 396 | 41 | 8986 | 45 |
| 47 | 3000 | 27 | 787 | 31 | 273 | 35 | 457 | 39 | 342 | 42 | 8927 | 46 |
| 48 | 2966 | 28 | 748 | 32 | 228 | 35 | 408 | 40 | 287 | 43 | 8867 | 47 |
| 49 | 2931 | 28 | 708 | 32 | 184 | 36 | 358 | 41 | 233 | 44 | 8808 | 48 |
| 50 | 2896 | 29 | 669 | 33 | 139 | 37 | 309 | 42 | 178 | 45 | 8748 | 49 |
| 51 | 992862 | 29 | 990629 | 34 | 988095 | 38 | 985259 | 42 | 982123 | 46 | 978689 | 50 |
| 52 | 827 | 30 | 589 | 34 | 8050 | 38 | 5209 | 43 | 2069 | 47 | 629 | 51 |
| 53 | 792 | 30 | 549 | 35 | 8005 | 39 | 5159 | 44 | 2014 | 48 | 569 | 52 |
| 54 | 757 | 31 | 510 | 36 | 7960 | 40 | 5109 | 45 | 1959 | 49 | 509 | 54 |
| 55 | 722 | 31 | 469 | 36 | 7915 | 41 | 5059 | 45 | 1904 | 50 | 449 | 55 |
| 56 | 687 | 32 | 429 | 37 | 7870 | 41 | 5009 | 46 | 1849 | 50 | 389 | 56 |
| 57 | 652 | 32 | 389 | 38 | 7825 | 42 | 4959 | 47 | 1793 | 51 | 329 | 57 |
| 58 | 617 | 33 | 349 | 38 | 7779 | 43 | 4909 | 48 | 1738 | 52 | 268 | 58 |
| 59 | 582 | 34 | 309 | 39 | 7734 | 44 | 4858 | 49 | 1683 | 53 | 208 | 59 |
| 60 | 546 | 34 | 268 | 39 | 7688 | 44 | 4808 | 50 | 1627 | 54 | 148 | 60 |

TABLE XXVIII.—(*continued*).

| ′ ″ | 12° Co-sine. | 12° Parts for ″ | 13° Co-sine. | 13° Parts for ″ | 14° Co-sine. | 14° Parts for ″ | 15° Co-sine. | 15° Parts for ″ | 16° Co-sine. | 16° Parts for ″ | 17° Co-sine. | 17° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 978148 | 0 | 974370 | 0 | 970296 | 0 | 965926 | 0 | 961262 | 0 | 956305 | 0 |
| 1 | 8087 | 1 | 4305 | 1 | 0225 | 1 | 850 | 1 | 1182 | 1 | 6220 | 1 |
| 2 | 8026 | 2 | 4239 | 2 | 0155 | 2 | 775 | 2 | 1101 | 3 | 6135 | 3 |
| 3 | 7966 | 3 | 4173 | 3 | 0084 | 3 | 700 | 4 | 1021 | 4 | 6049 | 4 |
| 4 | 7905 | 4 | 4108 | 4 | 0014 | 5 | 624 | 5 | 0940 | 5 | 5964 | 6 |
| 5 | 7844 | 5 | 4042 | 6 | 969943 | 6 | 548 | 6 | 0860 | 7 | 5879 | 7 |
| 6 | 7783 | 6 | 3976 | 7 | 9872 | 7 | 473 | 8 | 0779 | 8 | 5793 | 9 |
| 7 | 7722 | 7 | 3910 | 8 | 9801 | 8 | 397 | 9 | 0698 | 9 | 5707 | 10 |
| 8 | 7661 | 8 | 3844 | 9 | 9730 | 9 | 321 | 10 | 0618 | 11 | 5622 | 11 |
| 9 | 7600 | 9 | 3778 | 10 | 9659 | 10 | 245 | 11 | 0537 | 12 | 5536 | 13 |
| 10 | 7539 | 10 | 3712 | 11 | 9588 | 12 | 169 | 13 | 0456 | 14 | 5450 | 14 |
| 11 | 977477 | 11 | 973645 | 13 | 969517 | 13 | 965093 | 14 | 960375 | 15 | 955364 | 16 |
| 12 | 7416 | 12 | 579 | 14 | 9445 | 14 | 5016 | 15 | 0294 | 16 | 5278 | 17 |
| 13 | 7354 | 13 | 512 | 15 | 9374 | 15 | 4940 | 16 | 0213 | 18 | 5192 | 19 |
| 14 | 7293 | 14 | 446 | 16 | 9302 | 16 | 4864 | 18 | 0131 | 19 | 5106 | 20 |
| 15 | 7231 | 15 | 379 | 17 | 9231 | 18 | 4787 | 19 | 0050 | 20 | 5020 | 22 |
| 16 | 7169 | 16 | 313 | 18 | 9159 | 19 | 4711 | 20 | 959968 | 22 | 4934 | 23 |
| 17 | 7108 | 17 | 246 | 19 | 9088 | 20 | 4634 | 21 | 9887 | 23 | 4847 | 24 |
| 18 | 7046 | 18 | 179 | 20 | 9016 | 21 | 4557 | 23 | 9805 | 24 | 4761 | 26 |
| 19 | 6984 | 19 | 112 | 21 | 8944 | 22 | 4481 | 24 | 9724 | 26 | 4674 | 27 |
| 20 | 6922 | 20 | 045 | 22 | 8872 | 24 | 4404 | 26 | 9642 | 27 | 4588 | 29 |
| 21 | 976859 | 22 | 972978 | 24 | 968800 | 25 | 964327 | 27 | 959560 | 28 | 954501 | 30 |
| 22 | 797 | 23 | 911 | 25 | 728 | 26 | 4250 | 28 | 9478 | 30 | 4414 | 32 |
| 23 | 735 | 24 | 843 | 26 | 656 | 27 | 4173 | 29 | 9396 | 31 | 4327 | 33 |
| 24 | 672 | 25 | 776 | 27 | 583 | 28 | 4095 | 31 | 9314 | 32 | 4240 | 35 |
| 25 | 610 | 26 | 708 | 28 | 511 | 30 | 4018 | 32 | 9232 | 34 | 4153 | 36 |
| 26 | 547 | 27 | 641 | 29 | 438 | 31 | 3941 | 33 | 9150 | 35 | 4066 | 37 |
| 27 | 485 | 28 | 573 | 30 | 366 | 32 | 3863 | 34 | 9067 | 36 | 3979 | 39 |
| 28 | 422 | 29 | 506 | 31 | 293 | 33 | 3786 | 36 | 8985 | 38 | 3892 | 40 |
| 29 | 359 | 30 | 438 | 32 | 220 | 34 | 3708 | 37 | 8902 | 39 | 3804 | 42 |
| 30 | 296 | 31 | 370 | 34 | 148 | 36 | 3631 | 38 | 8820 | 41 | 3717 | 44 |
| 31 | 976233 | 32 | 972302 | 35 | 968075 | 37 | 963553 | 40 | 958737 | 43 | 953629 | 45 |
| 32 | 6170 | 33 | 2234 | 36 | 8002 | 38 | 3475 | 42 | 8654 | 44 | 3542 | 47 |
| 33 | 6107 | 35 | 2166 | 38 | 7929 | 40 | 3397 | 43 | 8572 | 46 | 3454 | 48 |
| 34 | 6044 | 36 | 2098 | 39 | 7856 | 41 | 3319 | 44 | 8489 | 47 | 3366 | 50 |
| 35 | 5980 | 37 | 2029 | 40 | 7783 | 43 | 3241 | 46 | 8406 | 49 | 3279 | 51 |
| 36 | 5917 | 38 | 1961 | 41 | 7709 | 44 | 3163 | 47 | 8323 | 50 | 3191 | 53 |
| 37 | 5853 | 39 | 1893 | 42 | 7636 | 45 | 3084 | 48 | 8239 | 51 | 3103 | 55 |
| 38 | 5790 | 40 | 1824 | 44 | 7562 | 47 | 3006 | 49 | 8156 | 53 | 3015 | 56 |
| 39 | 5726 | 41 | 1755 | 45 | 7489 | 48 | 2928 | 51 | 8073 | 54 | 2926 | 58 |
| 40 | 5662 | 42 | 1687 | 46 | 7415 | 49 | 2849 | 52 | 7990 | 55 | 2838 | 59 |
| 41 | 975599 | 43 | 971618 | 47 | 967342 | 50 | 962770 | 53 | 957906 | 57 | 952750 | 61 |
| 42 | 535 | 44 | 1549 | 48 | 7268 | 52 | 692 | 55 | 823 | 58 | 2662 | 62 |
| 43 | 471 | 45 | 1480 | 49 | 7194 | 53 | 613 | 56 | 739 | 59 | 2573 | 64 |
| 44 | 407 | 46 | 1411 | 50 | 7120 | 54 | 534 | 57 | 655 | 61 | 2484 | 65 |
| 45 | 342 | 47 | 1342 | 52 | 7046 | 55 | 455 | 59 | 571 | 62 | 2396 | 67 |
| 46 | 278 | 49 | 1273 | 53 | 6972 | 57 | 376 | 60 | 488 | 64 | 2307 | 68 |
| 47 | 214 | 50 | 1204 | 54 | 6898 | 58 | 297 | 61 | 404 | 65 | 2218 | 70 |
| 48 | 149 | 51 | 1134 | 55 | 6823 | 59 | 218 | 63 | 320 | 66 | 2129 | 71 |
| 49 | 085 | 52 | 1065 | 56 | 6749 | 60 | 139 | 64 | 235 | 68 | 2040 | 73 |
| 50 | 020 | 53 | 0995 | 57 | 6675 | 62 | 059 | 65 | 151 | 69 | 1951 | 74 |
| 51 | 974956 | 54 | 970926 | 59 | 966600 | 63 | 961980 | 67 | 957067 | 71 | 951862 | 76 |
| 52 | 891 | 55 | 856 | 60 | 6526 | 64 | 901 | 68 | 6983 | 72 | 773 | 77 |
| 53 | 826 | 56 | 786 | 61 | 6451 | 65 | 821 | 69 | 6898 | 74 | 684 | 79 |
| 54 | 761 | 57 | 717 | 62 | 6376 | 66 | 741 | 71 | 6814 | 75 | 594 | 80 |
| 55 | 696 | 58 | 647 | 63 | 6301 | 68 | 662 | 72 | 6729 | 77 | 505 | 82 |
| 56 | 631 | 59 | 577 | 64 | 6226 | 69 | 582 | 73 | 6644 | 78 | 415 | 83 |
| 57 | 566 | 60 | 507 | 66 | 6151 | 70 | 502 | 75 | 6560 | 80 | 326 | 85 |
| 58 | 501 | 61 | 436 | 67 | 6076 | 72 | 422 | 76 | 6475 | 81 | 236 | 86 |
| 59 | 436 | 62 | 366 | 68 | 6001 | 73 | 342 | 78 | 6390 | 82 | 146 | 88 |
| 60 | 370 | 64 | 296 | 69 | 5926 | 74 | 262 | 79 | 6305 | 83 | 057 | 89 |

TABLE XXVIII.—(*continued*).

| ′ ″ | 18° Co-sine. | 18° Parts for ″ | 19° Co-sine. | 19° Parts for ″ | 20° Co-sine. | 20° Parts for ″ | 21° Co-sine. | 21° Parts for ″ | 22° Co-sine. | 22° Parts for ″ | 23° Co-sine. | 23° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 951057 | 0 | 945519 | 0 | 939693 | 0 | 933580 | 0 | 927184 | 0 | 920505 | 0 |
| 1 | 0967 | 2 | 5424 | 2 | 9593 | 2 | 3476 | 2 | 7075 | 2 | 0391 | 2 |
| 2 | 0877 | 3 | 5329 | 3 | 9494 | 3 | 3372 | 4 | 6966 | 4 | 0277 | 4 |
| 3 | 0787 | 5 | 5234 | 5 | 9394 | 5 | 3267 | 5 | 6857 | 5 | 0164 | 6 |
| 4 | 0696 | 6 | 5139 | 6 | 9294 | 7 | 3163 | 7 | 6747 | 7 | 0050 | 8 |
| 5 | 0606 | 8 | 5044 | 8 | 9194 | 8 | 3058 | 9 | 6638 | 9 | 919936 | 10 |
| 6 | 0516 | 9 | 4949 | 10 | 9094 | 10 | 2954 | 11 | 6529 | 11 | 9822 | 11 |
| 7 | 0425 | 11 | 4854 | 11 | 8994 | 12 | 2849 | 12 | 6419 | 13 | 9707 | 13 |
| 8 | 0335 | 12 | 4758 | 13 | 8894 | 13 | 2744 | 14 | 6310 | 15 | 9593 | 15 |
| 9 | 0244 | 14 | 4663 | 14 | 8794 | 15 | 2639 | 16 | 6200 | 17 | 9479 | 17 |
| 10 | 0154 | 15 | 4568 | 16 | 8694 | 17 | 2531 | 18 | 6090 | 18 | 9364 | 19 |
| 11 | 950063 | 17 | 944472 | 18 | 938593 | 18 | 932429 | 19 | 925981 | 20 | 919250 | 21 |
| 12 | 949972 | 18 | 4376 | 19 | 8493 | 20 | 2324 | 21 | 5871 | 22 | 9135 | 23 |
| 13 | 9881 | 20 | 4281 | 21 | 8393 | 22 | 2219 | 23 | 5761 | 24 | 9021 | 25 |
| 14 | 9790 | 21 | 4185 | 22 | 8292 | 23 | 2113 | 25 | 5651 | 26 | 8906 | 27 |
| 15 | 9699 | 23 | 4089 | 24 | 8191 | 25 | 2008 | 26 | 5541 | 28 | 8791 | 29 |
| 16 | 9608 | 24 | 3993 | 26 | 8091 | 27 | 1902 | 28 | 5430 | 29 | 8676 | 31 |
| 17 | 9517 | 26 | 3897 | 27 | 7990 | 28 | 1797 | 30 | 5320 | 31 | 8561 | 33 |
| 18 | 9426 | 27 | 3801 | 29 | 7889 | 30 | 1691 | 32 | 5210 | 33 | 8446 | 35 |
| 19 | 9334 | 29 | 3705 | 30 | 7788 | 32 | 1586 | 33 | 5099 | 35 | 8331 | 37 |
| 20 | 9243 | 30 | 3609 | 32 | 7687 | 34 | 1480 | 35 | 4989 | 37 | 8216 | 38 |
| 21 | 949151 | 32 | 943512 | 34 | 937586 | 35 | 931374 | 37 | 924878 | 39 | 918101 | 40 |
| 22 | 9060 | 33 | 3416 | 35 | 7485 | 37 | 1268 | 39 | 4768 | 40 | 7986 | 42 |
| 23 | 8968 | 35 | 3319 | 37 | 7383 | 39 | 1162 | 40 | 4657 | 42 | 7870 | 44 |
| 24 | 8876 | 36 | 3223 | 38 | 7282 | 40 | 1056 | 42 | 4546 | 44 | 7755 | 46 |
| 25 | 8784 | 38 | 3126 | 40 | 7181 | 42 | 0950 | 44 | 4435 | 46 | 7639 | 48 |
| 26 | 8692 | 39 | 3029 | 42 | 7079 | 44 | 0843 | 46 | 4324 | 48 | 7523 | 50 |
| 27 | 8600 | 41 | 2932 | 43 | 6977 | 46 | 0737 | 48 | 4213 | 50 | 7408 | 52 |
| 28 | 8508 | 42 | 2836 | 45 | 6876 | 47 | 0631 | 50 | 4102 | 52 | 7292 | 54 |
| 29 | 8416 | 44 | 2739 | 47 | 6774 | 49 | 0524 | 52 | 3991 | 54 | 7176 | 56 |
| 30 | 8324 | 46 | 2642 | 48 | 6672 | 51 | 0418 | 53 | 3880 | 56 | 7060 | 58 |
| 31 | 948231 | 48 | 942544 | 51 | 936570 | 53 | 930311 | 55 | 923768 | 58 | 916944 | 60 |
| 32 | 8139 | 50 | 2447 | 52 | 6468 | 55 | 0204 | 57 | 3657 | 60 | 6828 | 62 |
| 33 | 8046 | 51 | 2350 | 54 | 6366 | 57 | 0097 | 59 | 3545 | 62 | 6712 | 64 |
| 34 | 7954 | 53 | 2253 | 56 | 6264 | 58 | 929991 | 61 | 3434 | 64 | 6596 | 66 |
| 35 | 7861 | 54 | 2155 | 57 | 6162 | 60 | 9884 | 63 | 3322 | 65 | 6479 | 68 |
| 36 | 7768 | 56 | 2058 | 59 | 6060 | 62 | 9777 | 65 | 3210 | 67 | 6363 | 70 |
| 37 | 7676 | 57 | 1960 | 60 | 5957 | 63 | 9969 | 67 | 3098 | 69 | 6246 | 72 |
| 38 | 7583 | 59 | 1862 | 62 | 5855 | 65 | 9562 | 69 | 2987 | 71 | 6130 | 74 |
| 39 | 7490 | 61 | 1764 | 64 | 5752 | 67 | 9455 | 71 | 2875 | 73 | 6013 | 76 |
| 40 | 7397 | 62 | 1667 | 66 | 5650 | 69 | 9348 | 72 | 2762 | 75 | 5896 | 78 |
| 41 | 947304 | 64 | 941569 | 67 | 935547 | 70 | 929240 | 74 | 922650 | 77 | 915780 | 80 |
| 42 | 7210 | 65 | 1471 | 69 | 5444 | 72 | 9133 | 76 | 2538 | 79 | 5663 | 82 |
| 43 | 7117 | 67 | 1372 | 71 | 5341 | 74 | 9025 | 78 | 2426 | 81 | 5546 | 84 |
| 44 | 7024 | 68 | 1274 | 72 | 5238 | 75 | 8917 | 80 | 2313 | 83 | 5429 | 86 |
| 45 | 6930 | 70 | 1176 | 74 | 5135 | 77 | 8810 | 81 | 2201 | 84 | 5312 | 88 |
| 46 | 6837 | 71 | 1078 | 75 | 5032 | 79 | 8702 | 83 | 2088 | 86 | 5194 | 90 |
| 47 | 6743 | 73 | 0979 | 77 | 4929 | 81 | 8594 | 85 | 1976 | 88 | 5077 | 92 |
| 48 | 6649 | 75 | 0881 | 79 | 4826 | 82 | 8486 | 87 | 1863 | 90 | 4960 | 94 |
| 49 | 6556 | 76 | 0782 | 80 | 4722 | 84 | 8378 | 89 | 1750 | 92 | 4842 | 96 |
| 50 | 6462 | 78 | 0684 | 82 | 4619 | 86 | 8270 | 90 | 1638 | 94 | 4725 | 98 |
| 51 | 946368 | 79 | 940585 | 84 | 934515 | 87 | 928161 | 92 | 921525 | 96 | 914607 | 100 |
| 52 | 6274 | 81 | 0486 | 85 | 4412 | 89 | 8053 | 94 | 1412 | 98 | 4490 | 102 |
| 53 | 6180 | 82 | 0387 | 87 | 4308 | 91 | 794 | 96 | 1299 | 100 | 4372 | 104 |
| 54 | 6085 | 84 | 0288 | 89 | 4205 | 93 | 7836 | 98 | 1185 | 101 | 4254 | 106 |
| 55 | 5991 | 85 | 0189 | 90 | 4101 | 95 | 7728 | 100 | 1072 | 103 | 4136 | 108 |
| 56 | 5897 | 87 | 0090 | 92 | 3997 | 96 | 7619 | 101 | 0959 | 105 | 4018 | 110 |
| 57 | 5802 | 88 | 939991 | 94 | 3893 | 98 | 7510 | 103 | 0846 | 107 | 3900 | 112 |
| 58 | 5708 | 90 | 9891 | 95 | 3789 | 100 | 7402 | 105 | 0732 | 109 | 3782 | 114 |
| 59 | 5613 | 92 | 9792 | 97 | 3685 | 101 | 7293 | 107 | 0619 | 110 | 3664 | 116 |
| 60 | 5519 | 93 | 9693 | 98 | 3580 | 103 | 7184 | 109 | 0505 | 112 | 3546 | 118 |

TABLE XXVIII.—(*continued*).

| ′ ″ | 24° Co-sine. | 24° Parts for ″ | 25° Co-sine. | 25° Parts for ″ | 26° Co-sine. | 26° Parts for ″ | 27° Co-sine. | 27° Parts for ″ | 28° Co-sine. | 28° Parts for ″ | 29° Co-sine. | 29° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 913546 | 0 | 906308 | 0 | 898794 | 0 | 891007 | 0 | 882948 | 0 | 874620 | 0 |
| 1 | 3427 | 2 | 6185 | 2 | 8667 | 2 | 0874 | 2 | 2811 | 2 | 4479 | 2 |
| 2 | 3309 | 4 | 6062 | 4 | 8539 | 4 | 0742 | 4 | 2674 | 4 | 4338 | 5 |
| 3 | 3190 | 6 | 5939 | 6 | 8411 | 6 | 0610 | 6 | 2538 | 6 | 4196 | 7 |
| 4 | 3072 | 8 | 5815 | 8 | 8283 | 8 | 0478 | 8 | 2401 | 9 | 4055 | 9 |
| 5 | 2953 | 10 | 5692 | 10 | 8156 | 11 | 0345 | 11 | 2264 | 11 | 3914 | 12 |
| 6 | 2834 | 12 | 5569 | 12 | 8028 | 13 | 0213 | 13 | 2127 | 13 | 3772 | 14 |
| 7 | 2715 | 14 | 5445 | 14 | 7900 | 15 | 0080 | 15 | 1990 | 16 | 3631 | 16 |
| 8 | 2597 | 16 | 5322 | 16 | 7772 | 17 | 889948 | 17 | 1853 | 18 | 3489 | 19 |
| 9 | 2478 | 18 | 5198 | 18 | 7643 | 19 | 9815 | 19 | 1716 | 21 | 3348 | 21 |
| 10 | 2358 | 20 | 5075 | 21 | 7515 | 21 | 9682 | 21 | 1578 | 23 | 3206 | 24 |
| 11 | 912239 | 22 | 904951 | 23 | 897387 | 23 | 889549 | 23 | 881441 | 25 | 873064 | 26 |
| 12 | 2120 | 24 | 4827 | 25 | 7258 | 26 | 9416 | 26 | 1304 | 27 | 2922 | 29 |
| 13 | 2001 | 26 | 4703 | 27 | 7130 | 28 | 9283 | 28 | 1166 | 30 | 2780 | 31 |
| 14 | 1882 | 28 | 4579 | 29 | 7001 | 30 | 9150 | 30 | 1028 | 32 | 2638 | 33 |
| 15 | 1762 | 30 | 4455 | 31 | 6873 | 32 | 9017 | 32 | 0891 | 34 | 2496 | 36 |
| 16 | 1643 | 32 | 4331 | 33 | 6744 | 34 | 8884 | 35 | 0753 | 37 | 2354 | 38 |
| 17 | 1523 | 34 | 4207 | 35 | 6615 | 36 | 8751 | 37 | 0615 | 39 | 2212 | 40 |
| 18 | 1403 | 36 | 4083 | 37 | 6486 | 38 | 8617 | 39 | 0477 | 41 | 2069 | 43 |
| 19 | 1284 | 38 | 3958 | 39 | 6358 | 40 | 8484 | 41 | 0339 | 43 | 1927 | 45 |
| 20 | 1164 | 40 | 3834 | 41 | 6229 | 43 | 8350 | 44 | 0201 | 46 | 1784 | 47 |
| 21 | 911044 | 42 | 903709 | 43 | 896099 | 45 | 888217 | 46 | 880063 | 48 | 871642 | 49 |
| 22 | 0924 | 44 | 3585 | 45 | 5970 | 47 | 8083 | 48 | 879925 | 52 | 1499 | 52 |
| 23 | 0804 | 46 | 3460 | 47 | 5841 | 49 | 7949 | 50 | 9787 | 54 | 1357 | 54 |
| 24 | 0684 | 48 | 3335 | 49 | 5712 | 52 | 7815 | 52 | 9649 | 56 | 1214 | 56 |
| 25 | 0564 | 50 | 3211 | 51 | 5582 | 54 | 7682 | 55 | 9510 | 58 | 1071 | 59 |
| 26 | 0443 | 52 | 3086 | 54 | 5453 | 57 | 7548 | 58 | 9372 | 60 | 0928 | 61 |
| 27 | 0323 | 54 | 2961 | 56 | 5323 | 58 | 7413 | 60 | 9233 | 62 | 0785 | 64 |
| 28 | 0202 | 56 | 2836 | 58 | 5194 | 60 | 7279 | 62 | 9095 | 64 | 0642 | 66 |
| 29 | 0082 | 58 | 2711 | 60 | 5064 | 62 | 7145 | 64 | 8956 | 67 | 0499 | 69 |
| 30 | 909961 | 60 | 2585 | 63 | 4934 | 65 | 7011 | 67 | 8817 | 69 | 0356 | 71 |
| 31 | 909841 | 62 | 902460 | 65 | 894805 | 67 | 886877 | 69 | 878678 | 71 | 870212 | 74 |
| 32 | 9720 | 64 | 2335 | 67 | 4675 | 69 | 6742 | 71 | 8539 | 73 | 0069 | 77 |
| 33 | 9599 | 66 | 2209 | 69 | 4545 | 71 | 6608 | 74 | 8400 | 76 | 869926 | 79 |
| 34 | 9478 | 68 | 2084 | 71 | 4415 | 73 | 6473 | 76 | 8261 | 78 | 9782 | 82 |
| 35 | 9357 | 70 | 1958 | 73 | 4284 | 75 | 6338 | 78 | 8122 | 81 | 9639 | 84 |
| 36 | 9236 | 72 | 1833 | 75 | 4154 | 78 | 6204 | 81 | 7983 | 84 | 9495 | 87 |
| 37 | 9115 | 74 | 1707 | 77 | 4024 | 80 | 6069 | 83 | 7844 | 86 | 9351 | 89 |
| 38 | 8994 | 76 | 1581 | 79 | 3894 | 82 | 5934 | 85 | 7704 | 89 | 9207 | 91 |
| 39 | 8873 | 78 | 1455 | 81 | 3763 | 84 | 5799 | 87 | 7565 | 91 | 9064 | 94 |
| 40 | 8751 | 80 | 1329 | 84 | 3633 | 86 | 5664 | 90 | 7425 | 93 | 8920 | 96 |
| 41 | 908630 | 82 | 901203 | 86 | 893502 | 89 | 885529 | 92 | 877286 | 95 | 868776 | 98 |
| 42 | 8508 | 84 | 1077 | 88 | 3371 | 91 | 5394 | 94 | 7146 | 97 | 8632 | 101 |
| 43 | 8387 | 86 | 0951 | 90 | 3241 | 93 | 5258 | 96 | 7006 | 100 | 8487 | 103 |
| 44 | 8265 | 88 | 0825 | 92 | 3110 | 95 | 5123 | 98 | 6867 | 102 | 8343 | 105 |
| 45 | 8143 | 90 | 0698 | 95 | 2979 | 97 | 4988 | 101 | 6727 | 105 | 8199 | 108 |
| 46 | 8021 | 92 | 0572 | 97 | 2848 | 100 | 4852 | 103 | 6587 | 107 | 8054 | 110 |
| 47 | 7900 | 94 | 0445 | 99 | 2717 | 102 | 4717 | 105 | 6447 | 109 | 7910 | 112 |
| 48 | 7778 | 96 | 0319 | 101 | 2586 | 104 | 4581 | 107 | 6307 | 112 | 7766 | 115 |
| 49 | 7655 | 98 | 0192 | 103 | 2455 | 106 | 4445 | 110 | 6167 | 114 | 7621 | 117 |
| 50 | 7533 | 100 | 0065 | 105 | 2323 | 108 | 4310 | 112 | 6026 | 117 | 7476 | 119 |
| 51 | 907411 | 102 | 899939 | 107 | 892192 | 111 | 884174 | 114 | 875886 | 119 | 867331 | 122 |
| 52 | 7289 | 104 | 9812 | 109 | 2061 | 113 | 4038 | 116 | 5746 | 122 | 7187 | 124 |
| 53 | 7167 | 106 | 9685 | 111 | 1929 | 115 | 3902 | 119 | 5605 | 124 | 7042 | 127 |
| 54 | 7044 | 109 | 9558 | 113 | 1798 | 117 | 3766 | 121 | 5465 | 126 | 6897 | 129 |
| 55 | 6922 | 111 | 9431 | 116 | 1666 | 119 | 3630 | 124 | 5324 | 129 | 6752 | 132 |
| 56 | 6799 | 113 | 9304 | 118 | 1534 | 122 | 3493 | 126 | 5183 | 131 | 6607 | 134 |
| 57 | 6676 | 115 | 9176 | 120 | 1402 | 124 | 3357 | 129 | 5042 | 133 | 6461 | 137 |
| 58 | 6554 | 117 | 9049 | 122 | 1271 | 126 | 3221 | 131 | 4902 | 136 | 6316 | 139 |
| 59 | 6431 | 119 | 8922 | 124 | 1139 | 129 | 3084 | 133 | 4761 | 138 | 6171 | 142 |
| 60 | 6308 | 121 | 8794 | 127 | 1007 | 131 | 2948 | 136 | 4620 | 140 | 6025 | 144 |

TABLE XXVIII.—(*continued*).

| ′ ″ | 30° Co-sine. | 30° Parts for ″ | 31° Co-sine. | 31° Parts for ″ | 32° Co-sine. | 32° Parts for ″ | 33° Co-sine. | 33° Parts for ″ | 34° Co-sine. | 34° Parts for ″ | 35° Co-sine. | 35° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 866025 | 0 | 857167 | 0 | 848048 | 0 | 838671 | 0 | 829038 | 0 | 819152 | 0 |
| 1 | 5880 | 2 | 7017 | 3 | 7894 | 3 | 8512 | 3 | 8875 | 3 | 8985 | 3 |
| 2 | 5734 | 5 | 6868 | 5 | 7740 | 5 | 8354 | 5 | 8712 | 6 | 8818 | 6 |
| 3 | 5589 | 7 | 6718 | 8 | 7585 | 8 | 8195 | 8 | 8549 | 8 | 8651 | 9 |
| 4 | 5443 | 9 | 6567 | 10 | 7431 | 10 | 8036 | 11 | 8386 | 11 | 8484 | 11 |
| 5 | 5297 | 12 | 6417 | 13 | 7277 | 13 | 7878 | 13 | 8223 | 14 | 8317 | 14 |
| 6 | 5151 | 15 | 6267 | 15 | 7122 | 16 | 7719 | 16 | 8060 | 16 | 8150 | 17 |
| 7 | 5006 | 17 | 6117 | 17 | 6967 | 18 | 7560 | 19 | 7897 | 19 | 7982 | 20 |
| 8 | 4860 | 19 | 5966 | 20 | 6813 | 20 | 7401 | 22 | 7734 | 22 | 7815 | 23 |
| 9 | 4713 | 22 | 5816 | 22 | 6658 | 23 | 7242 | 24 | 7571 | 25 | 7648 | 25 |
| 10 | 4567 | 24 | 5666 | 25 | 6503 | 26 | 7083 | 27 | 7407 | 27 | 7480 | 28 |
| 11 | 864421 | 27 | 855515 | 27 | 846348 | 28 | 836924 | 29 | 827244 | 30 | 817313 | 31 |
| 12 | 4275 | 29 | 5364 | 30 | 6193 | 31 | 6764 | 32 | 7081 | 33 | 7145 | 34 |
| 13 | 4128 | 32 | 5214 | 32 | 6038 | 33 | 6605 | 35 | 6917 | 36 | 6977 | 36 |
| 14 | 3982 | 34 | 5063 | 35 | 5883 | 36 | 6446 | 38 | 6753 | 38 | 6809 | 39 |
| 15 | 3836 | 37 | 4912 | 38 | 5728 | 39 | 6286 | 40 | 6590 | 41 | 6642 | 42 |
| 16 | 3689 | 39 | 4761 | 40 | 5573 | 41 | 6127 | 43 | 6426 | 44 | 6474 | 44 |
| 17 | 3542 | 41 | 4610 | 43 | 5417 | 44 | 5967 | 46 | 6262 | 47 | 6306 | 47 |
| 18 | 3396 | 44 | 4459 | 45 | 5262 | 47 | 5807 | 48 | 6098 | 49 | 6138 | 50 |
| 19 | 3249 | 46 | 4308 | 47 | 5106 | 49 | 5648 | 51 | 5934 | 52 | 5970 | 53 |
| 20 | 3102 | 49 | 4156 | 50 | 4951 | 52 | 5488 | 54 | 5770 | 55 | 5801 | 56 |
| 21 | 862955 | 51 | 854005 | 52 | 844795 | 54 | 835328 | 56 | 825606 | 57 | 815633 | 58 |
| 22 | 2808 | 54 | 3854 | 55 | 4640 | 57 | 5168 | 59 | 5442 | 60 | 5465 | 61 |
| 23 | 2661 | 56 | 3702 | 57 | 4484 | 60 | 5008 | 62 | 5278 | 63 | 5296 | 64 |
| 24 | 2514 | 59 | 3551 | 60 | 4328 | 62 | 4848 | 65 | 5113 | 65 | 5128 | 67 |
| 25 | 2366 | 61 | 3399 | 62 | 4172 | 65 | 4688 | 67 | 4949 | 68 | 4959 | 70 |
| 26 | 2219 | 63 | 3248 | 65 | 4016 | 68 | 4527 | 70 | 4785 | 71 | 4791 | 73 |
| 27 | 2072 | 66 | 3096 | 67 | 3860 | 72 | 4367 | 72 | 4620 | 73 | 4622 | 76 |
| 28 | 1924 | 68 | 2944 | 70 | 3704 | 74 | 4207 | 75 | 4456 | 76 | 4453 | 79 |
| 29 | 1777 | 71 | 2792 | 73 | 3548 | 76 | 4046 | 78 | 4291 | 79 | 4284 | 82 |
| 30 | 1629 | 74 | 2640 | 76 | 3391 | 78 | 3886 | 81 | 4126 | 82 | 4116 | 84 |
| 31 | 861482 | 77 | 852488 | 78 | 843235 | 81 | 833725 | 84 | 823961 | 84 | 813947 | 87 |
| 32 | 1334 | 80 | 2336 | 81 | 3079 | 84 | 3565 | 87 | 3797 | 87 | 3778 | 90 |
| 33 | 1186 | 82 | 2184 | 83 | 2922 | 87 | 3404 | 90 | 3632 | 90 | 3608 | 93 |
| 34 | 1038 | 84 | 2032 | 85 | 2766 | 90 | 3243 | 93 | 3467 | 93 | 3439 | 95 |
| 35 | 0890 | 87 | 1879 | 88 | 2609 | 92 | 3082 | 95 | 3302 | 96 | 3270 | 98 |
| 36 | 0742 | 89 | 1727 | 90 | 2452 | 94 | 2921 | 98 | 3136 | 99 | 3101 | 101 |
| 37 | 0594 | 92 | 1575 | 93 | 2296 | 97 | 2760 | 101 | 2971 | 102 | 2931 | 104 |
| 38 | 0446 | 94 | 1422 | 96 | 2139 | 99 | 2599 | 103 | 2806 | 105 | 2762 | 107 |
| 39 | 0298 | 97 | 1269 | 99 | 1982 | 102 | 2438 | 106 | 2641 | 108 | 2592 | 110 |
| 40 | 0149 | 99 | 1117 | 102 | 1825 | 105 | 2277 | 108 | 2475 | 111 | 2423 | 113 |
| 41 | 860001 | 102 | 850964 | 105 | 841668 | 108 | 832115 | 111 | 822310 | 114 | 812253 | 115 |
| 42 | 859852 | 103 | 0811 | 107 | 1511 | 111 | 1954 | 114 | 2144 | 116 | 2084 | 118 |
| 43 | 9704 | 106 | 0658 | 109 | 1354 | 113 | 1793 | 116 | 1978 | 119 | 1914 | 121 |
| 44 | 9555 | 109 | 0505 | 111 | 1196 | 115 | 1631 | 119 | 1813 | 122 | 1744 | 124 |
| 45 | 9406 | 112 | 0352 | 114 | 1039 | 118 | 1470 | 121 | 1647 | 125 | 1574 | 127 |
| 46 | 9258 | 114 | 0199 | 117 | 0882 | 121 | 1308 | 124 | 1481 | 128 | 1404 | 130 |
| 47 | 9109 | 116 | 0046 | 119 | 0724 | 123 | 1146 | 127 | 1315 | 131 | 1234 | 133 |
| 48 | 8960 | 118 | 849893 | 122 | 0567 | 126 | 0984 | 129 | 1149 | 134 | 1064 | 136 |
| 49 | 8811 | 121 | 9739 | 125 | 0409 | 128 | 0823 | 132 | 0983 | 136 | 0894 | 139 |
| 50 | 8662 | 124 | 9586 | 128 | 0251 | 131 | 0661 | 135 | 0817 | 139 | 0723 | 142 |
| 51 | 858513 | 126 | 849433 | 131 | 840094 | 134 | 830499 | 138 | 820651 | 142 | 810553 | 144 |
| 52 | 8364 | 129 | 9279 | 133 | 839936 | 136 | 0337 | 141 | 0485 | 145 | 0383 | 147 |
| 53 | 8214 | 131 | 9125 | 135 | 9778 | 139 | 0174 | 143 | 0318 | 147 | 0212 | 150 |
| 54 | 8065 | 134 | 8972 | 138 | 9620 | 142 | 0012 | 146 | 0152 | 150 | 0042 | 153 |
| 55 | 7916 | 136 | 8818 | 140 | 9462 | 144 | 829850 | 148 | 819985 | 153 | 809871 | 156 |
| 56 | 7766 | 139 | 8664 | 143 | 9304 | 147 | 9688 | 151 | 9819 | 156 | 9700 | 159 |
| 57 | 7616 | 142 | 8510 | 145 | 9146 | 150 | 9525 | 154 | 9652 | 158 | 9530 | 162 |
| 58 | 7467 | 145 | 8356 | 148 | 8987 | 152 | 9363 | 156 | 9486 | 161 | 9359 | 164 |
| 59 | 7317 | 147 | 8202 | 151 | 8829 | 155 | 9200 | 159 | 9319 | 164 | 9188 | 167 |
| 60 | 7167 | 149 | 8048 | 153 | 8671 | 157 | 9038 | 162 | 9152 | 166 | 9017 | 170 |

TABLE XXVIII.—(*continued*).

| ′ | 36° Co-sine. | 36° Parts for ″ | 37° Co-sine. | 37° Parts for ″ | 38° Co-sine. | 38° Parts for ″ | 39° Co-sine. | 39° Parts for ″ | 40° Co-sine. | 40° Parts for ″ | 41° Co-sine. | 41° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 809017 | 0 | 798636 | 0 | 788011 | 0 | 777146 | 0 | 766044 | 0 | 754710 | 0 |
| 1 | 8846 | 3 | 8460 | 3 | 7832 | 3 | 6963 | 3 | 5857 | 3 | 4519 | 3 |
| 2 | 8675 | 6 | 8285 | 6 | 7652 | 6 | 6780 | 6 | 5670 | 6 | 4328 | 6 |
| 3 | 8504 | 9 | 8110 | 9 | 7473 | 9 | 6596 | 9 | 5483 | 9 | 4137 | 10 |
| 4 | 8333 | 11 | 7935 | 12 | 7294 | 12 | 6413 | 12 | 5296 | 13 | 3946 | 13 |
| 5 | 8161 | 14 | 7759 | 15 | 7114 | 15 | 6230 | 15 | 5109 | 16 | 3755 | 16 |
| 6 | 7990 | 17 | 7584 | 18 | 6935 | 18 | 6046 | 18 | 4921 | 19 | 3563 | 19 |
| 7 | 7819 | 20 | 7408 | 20 | 6756 | 21 | 5863 | 21 | 4734 | 22 | 3372 | 22 |
| 8 | 7647 | 23 | 7233 | 23 | 6576 | 24 | 5679 | 24 | 4547 | 25 | 3181 | 25 |
| 9 | 7475 | 26 | 7057 | 26 | 6396 | 27 | 5496 | 27 | 4359 | 28 | 2989 | 28 |
| 10 | 7304 | 29 | 6882 | 29 | 6217 | 30 | 5312 | 31 | 4171 | 31 | 2798 | 32 |
| 11 | 807132 | 32 | 796706 | 32 | 786037 | 33 | 775128 | 34 | 763984 | 34 | 752606 | 35 |
| 12 | 6960 | 34 | 6530 | 35 | 5857 | 36 | 4945 | 37 | 3796 | 38 | 2415 | 38 |
| 13 | 6789 | 37 | 6354 | 38 | 5677 | 39 | 4761 | 40 | 3608 | 41 | 2223 | 41 |
| 14 | 6617 | 40 | 6178 | 41 | 5497 | 42 | 4577 | 43 | 3420 | 44 | 2032 | 44 |
| 15 | 6445 | 43 | 6002 | 44 | 5317 | 45 | 4393 | 46 | 3232 | 47 | 1840 | 48 |
| 16 | 6273 | 46 | 5826 | 47 | 5137 | 48 | 4209 | 49 | 3044 | 50 | 1648 | 51 |
| 17 | 6101 | 49 | 5650 | 50 | 4957 | 51 | 4024 | 52 | 2856 | 53 | 1456 | 54 |
| 18 | 5928 | 52 | 5473 | 53 | 4776 | 54 | 3840 | 55 | 2668 | 57 | 1264 | 57 |
| 19 | 5756 | 55 | 5297 | 56 | 4596 | 57 | 3656 | 58 | 2480 | 60 | 1072 | 60 |
| 20 | 5584 | 57 | 5121 | 59 | 4416 | 60 | 3472 | 61 | 2292 | 63 | 0880 | 64 |
| 21 | 805411 | 60 | 794944 | 62 | 784235 | 63 | 773287 | 65 | 762104 | 66 | 750688 | 67 |
| 22 | 5239 | 63 | 4768 | 65 | 4055 | 66 | 3103 | 68 | 1915 | 69 | 0496 | 70 |
| 23 | 5066 | 66 | 4591 | 68 | 3874 | 69 | 2918 | 71 | 1727 | 72 | 0303 | 73 |
| 24 | 4894 | 69 | 4415 | 71 | 3694 | 72 | 2734 | 74 | 1538 | 75 | 0111 | 86 |
| 25 | 4721 | 72 | 4238 | 74 | 3513 | 75 | 2549 | 77 | 1350 | 78 | 749919 | 80 |
| 26 | 4548 | 75 | 4061 | 76 | 3332 | 78 | 2364 | 80 | 1161 | 82 | 9726 | 83 |
| 27 | 4376 | 78 | 3884 | 79 | 3151 | 81 | 2179 | 83 | 0972 | 85 | 9534 | 86 |
| 28 | 4203 | 81 | 3707 | 82 | 2970 | 84 | 1995 | 86 | 0784 | 88 | 9341 | 89 |
| 29 | 4030 | 84 | 3530 | 85 | 2789 | 87 | 1810 | 89 | 0595 | 91 | 9148 | 92 |
| 30 | 3857 | 86 | 3353 | 88 | 2608 | 90 | 1625 | 92 | 0406 | 94 | 8956 | 96 |
| 31 | 803684 | 89 | 793176 | 92 | 782427 | 94 | 771440 | 97 | 760217 | 98 | 748763 | 101 |
| 32 | 3511 | 92 | 2999 | 95 | 2246 | 97 | 1254 | 100 | 0028 | 101 | 8570 | 104 |
| 33 | 3338 | 95 | 2822 | 98 | 2065 | 100 | 1069 | 103 | 759839 | 105 | 8377 | 107 |
| 34 | 3164 | 98 | 2644 | 101 | 1883 | 103 | 0884 | 106 | 9650 | 108 | 8184 | 110 |
| 35 | 2991 | 101 | 2467 | 104 | 1702 | 106 | 0699 | 109 | 9461 | 111 | 7991 | 113 |
| 36 | 2818 | 104 | 2290 | 107 | 1520 | 109 | 0513 | 112 | 9271 | 114 | 7798 | 117 |
| 37 | 2644 | 107 | 2112 | 110 | 1339 | 112 | 0328 | 115 | 9082 | 117 | 7605 | 120 |
| 38 | 2471 | 110 | 1935 | 113 | 1157 | 115 | 0142 | 118 | 8893 | 120 | 7412 | 123 |
| 39 | 2297 | 113 | 1757 | 116 | 0976 | 118 | 769957 | 121 | 8703 | 123 | 7218 | 126 |
| 40 | 2123 | 116 | 1579 | 119 | 0794 | 121 | 9771 | 124 | 8514 | 127 | 7025 | 129 |
| 41 | 801950 | 118 | 791401 | 121 | 780612 | 125 | 769585 | 127 | 758324 | 130 | 746832 | 133 |
| 42 | 1776 | 121 | 1224 | 124 | 0430 | 128 | 9400 | 130 | 8134 | 133 | 6638 | 136 |
| 43 | 1602 | 124 | 1046 | 127 | 0249 | 131 | 9214 | 133 | 7945 | 136 | 6445 | 139 |
| 44 | 1428 | 127 | 0868 | 130 | 0067 | 134 | 9028 | 136 | 7755 | 139 | 6251 | 142 |
| 45 | 1254 | 130 | 0690 | 133 | 779884 | 137 | 8842 | 139 | 7565 | 142 | 6057 | 145 |
| 46 | 1080 | 133 | 0512 | 136 | 9702 | 140 | 8656 | 143 | 7375 | 146 | 5864 | 149 |
| 47 | 0906 | 136 | 0333 | 139 | 9520 | 143 | 8470 | 146 | 7185 | 149 | 5670 | 152 |
| 48 | 0731 | 139 | 0155 | 142 | 9338 | 146 | 8284 | 149 | 6995 | 152 | 5476 | 155 |
| 49 | 0557 | 142 | 789977 | 145 | 9156 | 149 | 8097 | 152 | 6805 | 155 | 5282 | 159 |
| 50 | 0383 | 145 | 9798 | 148 | 8973 | 152 | 7911 | 155 | 6615 | 158 | 5088 | 162 |
| 51 | 800208 | 147 | 789620 | 151 | 778791 | 155 | 767725 | 158 | 756425 | 161 | 744894 | 166 |
| 52 | 0034 | 150 | 9441 | 154 | 8608 | 158 | 7538 | 161 | 6234 | 165 | 4700 | 169 |
| 53 | 799859 | 153 | 9263 | 157 | 8426 | 161 | 7352 | 164 | 6044 | 168 | 4506 | 172 |
| 54 | 9685 | 156 | 9084 | 160 | 8243 | 164 | 7165 | 167 | 5854 | 171 | 4312 | 175 |
| 55 | 9510 | 159 | 8905 | 163 | 8060 | 167 | 6979 | 171 | 5663 | 174 | 4117 | 178 |
| 56 | 9335 | 162 | 8727 | 166 | 7878 | 170 | 6792 | 174 | 5472 | 177 | 3923 | 181 |
| 57 | 9160 | 165 | 8548 | 169 | 7695 | 173 | 6605 | 177 | 5282 | 180 | 3728 | 184 |
| 58 | 8985 | 168 | 8369 | 172 | 7512 | 176 | 6418 | 180 | 5091 | 184 | 3534 | 188 |
| 59 | 8811 | 171 | 8190 | 175 | 7329 | 179 | 6231 | 183 | 4900 | 187 | 3339 | 191 |
| 60 | 8636 | 174 | 8011 | 178 | 7146 | 182 | 6044 | 186 | 4710 | 190 | 3145 | 194 |

TABLE XXVIII.—(*continued*).

| ′ ″ | 42° Co-sine. | 42° Parts for ″ | 43° Co-sine. | 43° Parts for ″ | 44° Co-sine. | 44° Parts for ″ | 45° Co-sine. | 45° Parts for ″ | 46° Co-sine. | 46° Parts for ″ | 47° Co-sine. | 47° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 743145 | 0 | 731354 | 0 | 719340 | 0 | 707107 | 0 | 694658 | 0 | 681998 | 0 |
| 1 | 2950 | 3 | 1155 | 3 | 9138 | 3 | 6901 | 3 | 4449 | 3 | 1786 | 4 |
| 2 | 2755 | 7 | 0957 | 7 | 8936 | 7 | 6695 | 7 | 4240 | 7 | 1573 | 7 |
| 3 | 2561 | 10 | 0758 | 10 | 8733 | 10 | 6489 | 10 | 4030 | 11 | 1360 | 10 |
| 4 | 2366 | 13 | 0560 | 13 | 8531 | 14 | 6284 | 14 | 3821 | 14 | 1147 | 14 |
| 5 | 2171 | 17 | 0361 | 16 | 8329 | 17 | 6078 | 17 | 3611 | 18 | 0934 | 18 |
| 6 | 1976 | 20 | 0162 | 20 | 8126 | 20 | 5872 | 21 | 3402 | 21 | 0721 | 21 |
| 7 | 1781 | 23 | 729963 | 23 | 7924 | 24 | 5666 | 24 | 3192 | 25 | 0508 | 25 |
| 8 | 1586 | 26 | 9765 | 26 | 7721 | 27 | 5459 | 28 | 2983 | 28 | 0295 | 28 |
| 9 | 1391 | 29 | 9566 | 29 | 7519 | 31 | 5253 | 31 | 2773 | 32 | 0081 | 32 |
| 10 | 1195 | 33 | 9367 | 33 | 7316 | 34 | 5047 | 34 | 2563 | 35 | 679868 | 36 |
| 11 | 741000 | 36 | 729168 | 36 | 717113 | 38 | 704841 | 38 | 692353 | 39 | 679655 | 39 |
| 12 | 0805 | 39 | 8969 | 39 | 6911 | 41 | 4634 | 41 | 2143 | 42 | 9441 | 43 |
| 13 | 0609 | 42 | 8770 | 42 | 6708 | 45 | 4428 | 45 | 1933 | 46 | 9228 | 46 |
| 14 | 0414 | 45 | 8570 | 46 | 6505 | 48 | 4221 | 48 | 1723 | 49 | 9014 | 50 |
| 15 | 0218 | 49 | 8371 | 50 | 6302 | 51 | 4015 | 52 | 1513 | 52 | 8801 | 53 |
| 16 | 0023 | 52 | 8172 | 53 | 6099 | 55 | 3808 | 55 | 1303 | 56 | 8587 | 57 |
| 17 | 739827 | 55 | 7972 | 56 | 5896 | 58 | 3601 | 59 | 1093 | 59 | 8373 | 60 |
| 18 | 9631 | 58 | 7773 | 60 | 5693 | 62 | 3395 | 62 | 0882 | 63 | 8160 | 64 |
| 19 | 9435 | 62 | 7573 | 63 | 5490 | 65 | 3188 | 66 | 0672 | 66 | 7946 | 67 |
| 20 | 9239 | 65 | 7374 | 66 | 5286 | 68 | 2981 | 69 | 0462 | 70 | 7732 | 71 |
| 21 | 739043 | 68 | 727174 | 70 | 715083 | 72 | 702774 | 73 | 690251 | 73 | 677518 | 74 |
| 22 | 8848 | 71 | 6974 | 73 | 4880 | 75 | 2567 | 76 | 0041 | 77 | 7304 | 78 |
| 23 | 8651 | 75 | 6775 | 76 | 4676 | 79 | 2360 | 80 | 689830 | 80 | 7090 | 81 |
| 24 | 8455 | 78 | 6575 | 80 | 4473 | 82 | 2153 | 83 | 9620 | 84 | 6876 | 85 |
| 25 | 8259 | 81 | 6375 | 83 | 4269 | 85 | 1946 | 86 | 9409 | 87 | 6662 | 89 |
| 26 | 8063 | 84 | 6175 | 86 | 4066 | 88 | 1789 | 90 | 9198 | 91 | 6448 | 92 |
| 27 | 7867 | 88 | 5975 | 90 | 3862 | 92 | 1531 | 93 | 8987 | 94 | 6233 | 96 |
| 28 | 7670 | 91 | 5775 | 93 | 3658 | 96 | 1324 | 97 | 8776 | 98 | 6019 | 99 |
| 29 | 7474 | 94 | 5575 | 96 | 3454 | 99 | 1117 | 100 | 8566 | 101 | 5805 | 103 |
| 30 | 7277 | 98 | 5374 | 100 | 3250 | 102 | 0909 | 103 | 8355 | 105 | 5590 | 107 |
| 31 | 737081 | 103 | 725174 | 104 | 713047 | 106 | 700702 | 107 | 688144 | 110 | 675376 | 111 |
| 32 | 6884 | 106 | 4974 | 107 | 2843 | 109 | 0494 | 111 | 7932 | 113 | 5161 | 115 |
| 33 | 6687 | 110 | 4773 | 110 | 2639 | 112 | 0287 | 114 | 7721 | 117 | 4947 | 118 |
| 34 | 6491 | 113 | 4573 | 113 | 2434 | 116 | 0079 | 118 | 7510 | 120 | 4732 | 122 |
| 35 | 6294 | 116 | 4372 | 117 | 2230 | 119 | 699871 | 121 | 7299 | 124 | 4517 | 125 |
| 36 | 6097 | 119 | 4172 | 120 | 2026 | 123 | 9663 | 125 | 7088 | 127 | 4302 | 129 |
| 37 | 5900 | 123 | 3971 | 123 | 1822 | 126 | 9455 | 128 | 6876 | 131 | 4088 | 133 |
| 38 | 5703 | 126 | 3771 | 127 | 1617 | 130 | 9248 | 132 | 6665 | 134 | 3873 | 136 |
| 39 | 5506 | 129 | 3570 | 130 | 1413 | 133 | 9040 | 135 | 6453 | 138 | 3658 | 140 |
| 40 | 5309 | 132 | 3369 | 134 | 1209 | 137 | 8832 | 139 | 6242 | 141 | 3443 | 143 |
| 41 | 735112 | 135 | 723168 | 137 | 711004 | 140 | 698623 | 142 | 686030 | 144 | 673228 | 147 |
| 42 | 4915 | 139 | 2967 | 141 | 0799 | 143 | 8415 | 145 | 5818 | 148 | 3013 | 151 |
| 43 | 4717 | 142 | 2766 | 144 | 0595 | 146 | 8207 | 149 | 5607 | 152 | 2797 | 154 |
| 44 | 4520 | 145 | 2565 | 147 | 0390 | 150 | 7999 | 152 | 5395 | 156 | 2582 | 158 |
| 45 | 4323 | 149 | 2364 | 150 | 0185 | 153 | 7790 | 156 | 5183 | 159 | 2367 | 161 |
| 46 | 4125 | 152 | 2163 | 154 | 709981 | 157 | 7582 | 159 | 4971 | 163 | 2151 | 165 |
| 47 | 3927 | 155 | 1962 | 157 | 9776 | 160 | 7374 | 163 | 4759 | 167 | 1936 | 169 |
| 48 | 3730 | 158 | 1760 | 161 | 9571 | 164 | 7165 | 166 | 4547 | 170 | 1721 | 172 |
| 49 | 3532 | 162 | 1559 | 164 | 9366 | 167 | 6957 | 170 | 4335 | 174 | 1505 | 176 |
| 50 | 3334 | 165 | 1357 | 168 | 9161 | 171 | 6748 | 173 | 4123 | 177 | 1290 | 179 |
| 51 | 733137 | 169 | 721156 | 171 | 708956 | 174 | 696539 | 177 | 683911 | 181 | 671074 | 183 |
| 52 | 2939 | 172 | 0954 | 174 | 8750 | 177 | 6330 | 180 | 3698 | 184 | 0858 | 186 |
| 53 | 2741 | 175 | 0753 | 177 | 8545 | 181 | 6122 | 184 | 3486 | 188 | 0642 | 190 |
| 54 | 2543 | 178 | 0551 | 181 | 8340 | 184 | 5913 | 187 | 3274 | 191 | 0427 | 193 |
| 55 | 2345 | 182 | 0349 | 184 | 8135 | 188 | 5704 | 191 | 3061 | 195 | 0211 | 197 |
| 56 | 2147 | 185 | 0148 | 188 | 7929 | 191 | 5495 | 194 | 2849 | 198 | 669995 | 201 |
| 57 | 1949 | 188 | 719946 | 191 | 7724 | 195 | 5286 | 198 | 2636 | 202 | 9779 | 204 |
| 58 | 1750 | 191 | 9744 | 194 | 7518 | 198 | 5077 | 201 | 2424 | 205 | 9563 | 208 |
| 59 | 1552 | 194 | 9542 | 197 | 7312 | 202 | 4868 | 205 | 2211 | 209 | 9347 | 211 |
| 60 | 1354 | 197 | 9340 | 201 | 7107 | 205 | 4658 | 208 | 1998 | 212 | 9131 | 214 |

TABLE XXVIII.—(*continued*).

| ′ | 48° | | 49° | | 50° | | 51° | | 52° | | 53° | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ |
| 0 | 669131 | 0 | 656059 | 0 | 642788 | 0 | 629320 | 0 | 615661 | 0 | 601815 | 0 |
| 1 | 8914 | 4 | 5840 | 4 | 2565 | 4 | 9094 | 4 | 5432 | 4 | 1583 | 4 |
| 2 | 8698 | 7 | 5620 | 7 | 2342 | 8 | 8868 | 8 | 5203 | 8 | 1350 | 8 |
| 3 | 8482 | 11 | 5400 | 11 | 2119 | 11 | 8642 | 11 | 4974 | 12 | 1118 | 12 |
| 4 | 8265 | 14 | 5180 | 15 | 1896 | 15 | 8416 | 15 | 4744 | 16 | 0885 | 16 |
| 5 | 8049 | 18 | 4961 | 19 | 1673 | 19 | 8189 | 19 | 4515 | 19 | 0653 | 19 |
| 6 | 7833 | 22 | 4741 | 22 | 1450 | 22 | 7963 | 23 | 4285 | 23 | 0420 | 23 |
| 7 | 7616 | 25 | 4521 | 26 | 1226 | 26 | 7737 | 26 | 4056 | 27 | 0188 | 27 |
| 8 | 7399 | 29 | 4301 | 30 | 1003 | 30 | 7510 | 30 | 3826 | 31 | 599955 | 31 |
| 9 | 7183 | 32 | 4081 | 33 | 0780 | 34 | 7284 | 34 | 3596 | 35 | 9722 | 35 |
| 10 | 6966 | 36 | 3861 | 37 | 0557 | 37 | 7057 | 38 | 3367 | 38 | 9489 | 39 |
| 11 | 666749 | 39 | 653641 | 41 | 640333 | 41 | 626830 | 42 | 613137 | 42 | 599256 | 43 |
| 12 | 6532 | 43 | 3421 | 44 | 0110 | 45 | 6604 | 45 | 2907 | 46 | 9024 | 47 |
| 13 | 6316 | 46 | 3200 | 48 | 639886 | 49 | 6377 | 49 | 2677 | 50 | 8791 | 50 |
| 14 | 6099 | 50 | 2980 | 52 | 9663 | 53 | 6150 | 53 | 2447 | 54 | 8558 | 54 |
| 15 | 5882 | 54 | 2760 | 55 | 9439 | 56 | 5923 | 57 | 2217 | 57 | 8325 | 58 |
| 16 | 5665 | 57 | 2539 | 59 | 9215 | 60 | 5697 | 61 | 1987 | 61 | 8092 | 62 |
| 17 | 5448 | 61 | 2319 | 63 | 8992 | 64 | 5470 | 64 | 1757 | 65 | 7858 | 66 |
| 18 | 5230 | 64 | 2098 | 66 | 8768 | 68 | 5243 | 68 | 1527 | 69 | 7625 | 70 |
| 19 | 5013 | 68 | 1878 | 70 | 8544 | 72 | 5016 | 72 | 1297 | 73 | 7392 | 74 |
| 20 | 4796 | 72 | 1657 | 73 | 8320 | 75 | 4789 | 76 | 1067 | 77 | 7159 | 78 |
| 21 | 664579 | 75 | 651437 | 77 | 638096 | 78 | 624561 | 80 | 610836 | 81 | 596925 | 82 |
| 22 | 4361 | 79 | 1216 | 81 | 7872 | 82 | 4334 | 84 | 0606 | 85 | 6692 | 86 |
| 23 | 4144 | 82 | 0995 | 85 | 7648 | 86 | 4107 | 88 | 0376 | 89 | 6458 | 90 |
| 24 | 3926 | 86 | 0774 | 89 | 7424 | 90 | 3880 | 92 | 0145 | 92 | 6225 | 94 |
| 25 | 3709 | 90 | 0553 | 93 | 7200 | 94 | 3652 | 95 | 609915 | 96 | 5991 | 98 |
| 26 | 3491 | 93 | 0332 | 96 | 6976 | 97 | 3425 | 99 | 9684 | 100 | 5758 | 102 |
| 27 | 3273 | 97 | 0111 | 100 | 6751 | 101 | 3197 | 103 | 9454 | 104 | 5524 | 106 |
| 28 | 3056 | 101 | 649890 | 103 | 6527 | 105 | 2970 | 107 | 9223 | 108 | 5290 | 110 |
| 29 | 2838 | 105 | 9669 | 107 | 6303 | 109 | 2742 | 111 | 8992 | 111 | 5057 | 114 |
| 30 | 2620 | 109 | 9448 | 110 | 6078 | 112 | 2515 | 114 | 8761 | 115 | 4823 | 117 |
| 31 | 662402 | 114 | 649227 | 115 | 635854 | 117 | 622287 | 119 | 608531 | 119 | 594589 | 121 |
| 32 | 2184 | 118 | 9006 | 118 | 5629 | 121 | 2059 | 123 | 8300 | 123 | 4355 | 125 |
| 33 | 1966 | 121 | 8784 | 122 | 5405 | 124 | 1831 | 127 | 8069 | 127 | 4121 | 129 |
| 34 | 1748 | 125 | 8563 | 126 | 5180 | 128 | 1604 | 131 | 7838 | 131 | 3887 | 133 |
| 35 | 1530 | 128 | 8341 | 129 | 4955 | 131 | 1376 | 134 | 7607 | 135 | 3653 | 137 |
| 36 | 1312 | 132 | 8120 | 133 | 4731 | 134 | 1148 | 138 | 7376 | 139 | 3419 | 141 |
| 37 | 1094 | 136 | 7898 | 137 | 4506 | 138 | 0920 | 142 | 7145 | 143 | 3185 | 145 |
| 38 | 0875 | 139 | 7677 | 141 | 4281 | 142 | 0692 | 146 | 6914 | 147 | 2951 | 149 |
| 39 | 0657 | 143 | 7455 | 144 | 4056 | 146 | 0464 | 150 | 6682 | 151 | 2716 | 153 |
| 40 | 0439 | 146 | 7233 | 148 | 3831 | 150 | 0235 | 153 | 6451 | 154 | 2482 | 156 |
| 41 | 660220 | 150 | 647012 | 152 | 633606 | 153 | 620007 | 157 | 606220 | 158 | 592248 | 160 |
| 42 | 0002 | 154 | 6790 | 155 | 3381 | 157 | 619779 | 161 | 5988 | 162 | 2013 | 164 |
| 43 | 659783 | 157 | 6568 | 159 | 3156 | 161 | 9551 | 165 | 5757 | 166 | 1779 | 168 |
| 44 | 9565 | 161 | 6346 | 163 | 2931 | 165 | 9322 | 169 | 5526 | 170 | 1544 | 172 |
| 45 | 9346 | 164 | 6124 | 167 | 2705 | 169 | 9094 | 172 | 5294 | 174 | 1310 | 176 |
| 46 | 9127 | 168 | 5902 | 171 | 2480 | 172 | 8865 | 176 | 5062 | 178 | 1075 | 180 |
| 47 | 8908 | 172 | 5680 | 174 | 2255 | 176 | 8637 | 180 | 4831 | 182 | 0840 | 184 |
| 48 | 8690 | 175 | 5458 | 178 | 2029 | 180 | 8408 | 184 | 4599 | 186 | 0606 | 188 |
| 49 | 8471 | 179 | 5236 | 181 | 1804 | 183 | 8180 | 188 | 4367 | 190 | 0371 | 192 |
| 50 | 8252 | 183 | 5013 | 185 | 1578 | 187 | 7951 | 191 | 4136 | 194 | 0136 | 195 |
| 51 | 658033 | 187 | 644791 | 188 | 631353 | 191 | 617722 | 195 | 603904 | 197 | 589901 | 199 |
| 52 | 7814 | 190 | 4569 | 192 | 1127 | 195 | 7494 | 199 | 3672 | 201 | 9666 | 203 |
| 53 | 7594 | 194 | 4346 | 196 | 0902 | 199 | 7265 | 203 | 3440 | 205 | 9431 | 207 |
| 54 | 7375 | 197 | 4124 | 200 | 0676 | 202 | 7036 | 206 | 3208 | 209 | 9196 | 211 |
| 55 | 7156 | 201 | 3901 | 204 | 0450 | 206 | 6807 | 210 | 2976 | 213 | 8961 | 215 |
| 56 | 6937 | 204 | 3679 | 207 | 0224 | 210 | 6578 | 214 | 2744 | 217 | 8726 | 219 |
| 57 | 6717 | 208 | 3456 | 211 | 629998 | 214 | 6349 | 218 | 2512 | 220 | 8491 | 223 |
| 58 | 6498 | 212 | 3233 | 215 | 9772 | 218 | 6120 | 221 | 2280 | 224 | 8256 | 227 |
| 59 | 6279 | 215 | 3010 | 218 | 9546 | 221 | 5891 | 225 | 2047 | 228 | 8021 | 231 |
| 60 | 6059 | 219 | 2788 | 222 | 9320 | 225 | 5661 | 228 | 1815 | 231 | 7785 | 234 |

TABLE XXVIII.—(*continued*).

| ′ | 54° | | 55° | | 56° | | 57° | | 58° | | 59° | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ |
| 0 | 587785 | 0 | 573576 | 0 | 559193 | 0 | 544639 | 0 | 529919 | 0 | 515038 | 0 |
| 1 | 7550 | 4 | 3338 | 4 | 8952 | 4 | 4395 | 4 | 9673 | 4 | 4789 | 4 |
| 2 | 7315 | 8 | 3100 | 8 | 8710 | 8 | 4151 | 8 | 9426 | 8 | 4539 | 8 |
| 3 | 7079 | 12 | 2861 | 12 | 8469 | 12 | 3907 | 12 | 9179 | 12 | 4290 | 12 |
| 4 | 6844 | 16 | 2623 | 16 | 8228 | 16 | 3663 | 16 | 8932 | 17 | 4040 | 17 |
| 5 | 6608 | 20 | 2384 | 20 | 7987 | 20 | 3419 | 20 | 8685 | 21 | 3791 | 21 |
| 6 | 6372 | 24 | 2146 | 24 | 7745 | 24 | 3174 | 24 | 8438 | 25 | 3541 | 25 |
| 7 | 6137 | 28 | 1907 | 28 | 7504 | 28 | 2930 | 28 | 8191 | 29 | 3292 | 29 |
| 8 | 5901 | 32 | 1669 | 32 | 7262 | 32 | 2686 | 32 | 7944 | 33 | 3042 | 33 |
| 9 | 5665 | 36 | 1430 | 36 | 7021 | 36 | 2442 | 37 | 7697 | 37 | 2792 | 37 |
| 10 | 5429 | 39 | 1191 | 40 | 6779 | 40 | 2197 | 41 | 7450 | 41 | 2543 | 42 |
| 11 | 585194 | 43 | 570952 | 44 | 556537 | 45 | 541953 | 45 | 527203 | 45 | 512293 | 46 |
| 12 | 4958 | 47 | 0714 | 48 | 6296 | 49 | 1708 | 49 | 6956 | 49 | 2043 | 50 |
| 13 | 4722 | 51 | 0475 | 52 | 6054 | 53 | 1464 | 53 | 6709 | 54 | 1793 | 54 |
| 14 | 4486 | 55 | 0236 | 56 | 5812 | 57 | 1219 | 57 | 6461 | 58 | 1543 | 58 |
| 15 | 4250 | 59 | 569997 | 60 | 5570 | 61 | 0975 | 61 | 6214 | 62 | 1293 | 63 |
| 16 | 4014 | 63 | 9758 | 64 | 5328 | 65 | 0730 | 65 | 5967 | 66 | 1043 | 67 |
| 17 | 3777 | 67 | 9519 | 68 | 5086 | 69 | 0485 | 69 | 5719 | 70 | 0793 | 71 |
| 18 | 3541 | 71 | 9280 | 72 | 4844 | 73 | 0240 | 73 | 5472 | 74 | 0543 | 75 |
| 19 | 3305 | 75 | 9040 | 76 | 4602 | 77 | 539996 | 77 | 5224 | 78 | 0293 | 79 |
| 20 | 3069 | 79 | 8801 | 80 | 4360 | 81 | 9751 | 81 | 4977 | 82 | 0043 | 83 |
| 21 | 582832 | 83 | 568562 | 84 | 554118 | 85 | 539506 | 86 | 524729 | 87 | 509792 | 87 |
| 22 | 2596 | 87 | 8323 | 88 | 3876 | 89 | 9261 | 90 | 4481 | 91 | 9542 | 91 |
| 23 | 2360 | 91 | 8083 | 92 | 3634 | 93 | 9016 | 94 | 4234 | 95 | 9292 | 95 |
| 24 | 2123 | 95 | 7844 | 96 | 3392 | 97 | 8771 | 98 | 3986 | 99 | 9041 | 99 |
| 25 | 1886 | 99 | 7604 | 100 | 3149 | 101 | 8526 | 102 | 3738 | 103 | 8791 | 104 |
| 26 | 1650 | 103 | 7365 | 104 | 2907 | 105 | 8281 | 106 | 3490 | 107 | 8541 | 108 |
| 27 | 1413 | 107 | 7125 | 108 | 2664 | 109 | 8035 | 110 | 3242 | 111 | 8290 | 112 |
| 28 | 1176 | 111 | 6886 | 112 | 2422 | 113 | 7790 | 114 | 2995 | 115 | 8040 | 117 |
| 29 | 0940 | 115 | 6646 | 116 | 2180 | 117 | 7545 | 118 | 2747 | 119 | 7789 | 121 |
| 30 | 0703 | 118 | 6406 | 120 | 1937 | 122 | 7300 | 122 | 2499 | 124 | 7538 | 126 |
| 31 | 580466 | 122 | 566166 | 124 | 551694 | 126 | 537054 | 127 | 522251 | 128 | 507288 | 130 |
| 32 | 0229 | 126 | 5927 | 128 | 1452 | 130 | 6809 | 131 | 2002 | 132 | 7037 | 134 |
| 33 | 579992 | 130 | 5687 | 132 | 1209 | 134 | 6563 | 135 | 1754 | 136 | 6786 | 138 |
| 34 | 9755 | 134 | 5447 | 136 | 0966 | 138 | 6318 | 139 | 1506 | 141 | 6536 | 142 |
| 35 | 9518 | 138 | 5207 | 140 | 0724 | 142 | 6072 | 143 | 1258 | 145 | 6285 | 146 |
| 36 | 9281 | 142 | 4967 | 144 | 0481 | 146 | 5827 | 148 | 1010 | 149 | 6034 | 151 |
| 37 | 9044 | 146 | 4727 | 148 | 0238 | 150 | 5581 | 152 | 0761 | 153 | 5783 | 155 |
| 38 | 8807 | 150 | 4487 | 152 | 549995 | 154 | 5336 | 156 | 0513 | 158 | 5532 | 159 |
| 39 | 8570 | 154 | 4247 | 156 | 9752 | 158 | 5090 | 160 | 0265 | 162 | 5281 | 163 |
| 40 | 8332 | 158 | 4007 | 160 | 9509 | 162 | 4844 | 164 | 0016 | 166 | 5030 | 168 |
| 41 | 578095 | 162 | 563766 | 164 | 549266 | 166 | 534598 | 168 | 519768 | 170 | 504779 | 172 |
| 42 | 7858 | 166 | 3526 | 168 | 9023 | 171 | 4352 | 172 | 9519 | 174 | 4528 | 176 |
| 43 | 7620 | 170 | 3286 | 172 | 8780 | 175 | 4107 | 176 | 9271 | 178 | 4277 | 180 |
| 44 | 7383 | 174 | 3045 | 176 | 8536 | 179 | 3861 | 180 | 9022 | 182 | 4025 | 184 |
| 45 | 7145 | 178 | 2805 | 180 | 8293 | 183 | 3615 | 184 | 8773 | 186 | 3774 | 188 |
| 46 | 6908 | 182 | 2564 | 184 | 8050 | 187 | 3369 | 189 | 8525 | 190 | 3523 | 193 |
| 47 | 6670 | 186 | 2324 | 188 | 7807 | 191 | 3122 | 193 | 8276 | 195 | 3271 | 197 |
| 48 | 6432 | 190 | 2083 | 192 | 7563 | 195 | 2876 | 197 | 8027 | 199 | 3020 | 201 |
| 49 | 6195 | 194 | 1843 | 196 | 7320 | 199 | 2630 | 201 | 7778 | 203 | 2769 | 205 |
| 50 | 5957 | 198 | 1602 | 200 | 7076 | 203 | 2384 | 205 | 7529 | 207 | 2517 | 210 |
| 51 | 575719 | 202 | 561361 | 204 | 546833 | 207 | 532138 | 209 | 517280 | 212 | 502266 | 214 |
| 52 | 5481 | 206 | 1121 | 208 | 6589 | 211 | 1891 | 213 | 7031 | 216 | 2014 | 218 |
| 53 | 5243 | 210 | 0880 | 212 | 6346 | 215 | 1645 | 217 | 6782 | 220 | 1762 | 222 |
| 54 | 5005 | 214 | 0639 | 216 | 6102 | 219 | 1399 | 221 | 6533 | 224 | 1511 | 226 |
| 55 | 4767 | 218 | 0398 | 220 | 5858 | 223 | 1152 | 226 | 6284 | 228 | 1259 | 230 |
| 56 | 4529 | 222 | 0157 | 224 | 5615 | 227 | 0906 | 230 | 6035 | 233 | 1007 | 235 |
| 57 | 4291 | 226 | 559916 | 228 | 5371 | 231 | 0659 | 234 | 5786 | 237 | 0756 | 239 |
| 58 | 4053 | 230 | 9675 | 232 | 5127 | 235 | 0413 | 238 | 5537 | 241 | 0504 | 243 |
| 59 | 3815 | 234 | 9434 | 236 | 4883 | 239 | 0166 | 242 | 5287 | 245 | 0252 | 247 |
| 60 | 3576 | 237 | 9193 | 240 | 4639 | 243 | 529919 | 246 | 5038 | 249 | 0000 | 251 |

TABLE XXVIII.—(*continued*).

| ′ | 60° | | 61° | | 62° | | 63° | | 64° | | 65° | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ |
| 0 | 500000 | 0 | 484810 | 0 | 469472 | 0 | 453991 | 0 | 438371 | 0 | 422618 | 0 |
| 1 | 499748 | 4 | 4555 | 4 | 9215 | 4 | 3731 | 4 | 8110 | 4 | 2355 | 4 |
| 2 | 9496 | 8 | 4301 | 8 | 8958 | 8 | 3472 | 9 | 7848 | 9 | 2091 | 9 |
| 3 | 9244 | 12 | 4046 | 13 | 8701 | 13 | 3213 | 13 | 7587 | 13 | 1827 | 13 |
| 4 | 8992 | 17 | 3792 | 17 | 8444 | 17 | 2954 | 17 | 7325 | 17 | 1563 | 18 |
| 5 | 8740 | 21 | 3537 | 21 | 8187 | 21 | 2694 | 22 | 7063 | 22 | 1300 | 22 |
| 6 | 8488 | 25 | 3282 | 25 | 7930 | 26 | 2435 | 26 | 6802 | 26 | 1036 | 26 |
| 7 | 8236 | 30 | 3028 | 30 | 7673 | 30 | 2175 | 30 | 6540 | 31 | 0772 | 31 |
| 8 | 7983 | 34 | 2773 | 34 | 7416 | 34 | 1916 | 35 | 6278 | 35 | 0508 | 35 |
| 9 | 7731 | 38 | 2518 | 38 | 7158 | 38 | 1656 | 39 | 6017 | 39 | 0244 | 40 |
| 10 | 7479 | 42 | 2263 | 43 | 6901 | 43 | 1397 | 43 | 5755 | 44 | 419980 | 44 |
| 11 | 497226 | 46 | 482009 | 47 | 466644 | 47 | 451137 | 48 | 435493 | 48 | 419716 | 48 |
| 12 | 6974 | 50 | 1754 | 51 | 6387 | 51 | 0878 | 52 | 5231 | 52 | 9452 | 53 |
| 13 | 6722 | 54 | 1499 | 55 | 6129 | 55 | 0618 | 56 | 4969 | 57 | 9188 | 57 |
| 14 | 6469 | 58 | 1244 | 59 | 5872 | 60 | 0358 | 61 | 4707 | 61 | 8924 | 62 |
| 15 | 6217 | 63 | 0989 | 63 | 5615 | 64 | 0098 | 65 | 4445 | 66 | 8660 | 66 |
| 16 | 5964 | 67 | 0734 | 67 | 5357 | 68 | 449839 | 69 | 4183 | 70 | 8396 | 71 |
| 17 | 5711 | 71 | 0479 | 72 | 5100 | 72 | 9579 | 74 | 3921 | 74 | 8131 | 75 |
| 18 | 5459 | 75 | 0224 | 76 | 4842 | 77 | 9319 | 78 | 3659 | 79 | 7867 | 79 |
| 19 | 5206 | 79 | 479968 | 80 | 4585 | 81 | 9059 | 82 | 3397 | 83 | 7603 | 84 |
| 20 | 4953 | 84 | 9713 | 85 | 4327 | 85 | 8799 | 87 | 3135 | 87 | 7339 | 88 |
| 21 | 494701 | 88 | 479458 | 89 | 464069 | 90 | 448539 | 91 | 432873 | 92 | 417074 | 92 |
| 22 | 4448 | 92 | 9203 | 93 | 3812 | 94 | 8279 | 95 | 2610 | 96 | 6810 | 97 |
| 23 | 4195 | 96 | 8947 | 97 | 3554 | 98 | 8019 | 100 | 2348 | 100 | 6545 | 101 |
| 24 | 3942 | 100 | 8692 | 101 | 3296 | 103 | 7759 | 104 | 2086 | 105 | 6281 | 106 |
| 25 | 3689 | 105 | 8436 | 106 | 3038 | 107 | 7499 | 108 | 1823 | 109 | 6016 | 110 |
| 26 | 3436 | 109 | 8181 | 110 | 2780 | 111 | 7239 | 113 | 1561 | 113 | 5752 | 114 |
| 27 | 3183 | 113 | 7926 | 115 | 2523 | 115 | 6979 | 117 | 1299 | 118 | 5487 | 119 |
| 28 | 2930 | 117 | 7670 | 119 | 2265 | 120 | 6718 | 121 | 1036 | 122 | 5223 | 123 |
| 29 | 2677 | 121 | 7414 | 123 | 2007 | 124 | 6458 | 126 | 0774 | 126 | 4958 | 128 |
| 30 | 2424 | 126 | 7159 | 128 | 1749 | 129 | 6198 | 130 | 0511 | 131 | 4693 | 132 |
| 31 | 492170 | 131 | 476903 | 132 | 461491 | 133 | 445938 | 134 | 430249 | 136 | 414429 | 137 |
| 32 | 1917 | 135 | 6647 | 136 | 1233 | 138 | 5677 | 139 | 429986 | 140 | 4164 | 141 |
| 33 | 1664 | 140 | 6392 | 141 | 0974 | 142 | 5417 | 143 | 9723 | 145 | 3899 | 146 |
| 34 | 1411 | 144 | 6136 | 145 | 0716 | 146 | 5156 | 147 | 9461 | 149 | 3634 | 150 |
| 35 | 1157 | 148 | 5880 | 149 | 0458 | 151 | 4896 | 152 | 9198 | 153 | 3369 | 154 |
| 36 | 0904 | 152 | 5624 | 154 | 0200 | 155 | 4635 | 156 | 8935 | 158 | 3104 | 159 |
| 37 | 0650 | 156 | 5368 | 158 | 459942 | 159 | 4375 | 160 | 8672 | 162 | 2840 | 163 |
| 38 | 0397 | 161 | 5112 | 162 | 9683 | 164 | 4114 | 165 | 8410 | 167 | 2575 | 168 |
| 39 | 0143 | 165 | 4856 | 166 | 9425 | 168 | 3853 | 169 | 8147 | 171 | 2310 | 172 |
| 40 | 489890 | 169 | 4600 | 171 | 9167 | 172 | 3593 | 174 | 7884 | 175 | 2045 | 177 |
| 41 | 489636 | 173 | 474344 | 175 | 458908 | 177 | 443332 | 178 | 427621 | 180 | 411780 | 181 |
| 42 | 9383 | 178 | 4088 | 179 | 8650 | 181 | 3071 | 182 | 7358 | 184 | 1514 | 185 |
| 43 | 9129 | 182 | 3832 | 183 | 8391 | 185 | 2810 | 187 | 7095 | 189 | 1249 | 189 |
| 44 | 8875 | 186 | 3576 | 187 | 8133 | 189 | 2550 | 191 | 6832 | 193 | 0984 | 194 |
| 45 | 8621 | 190 | 3320 | 192 | 7874 | 194 | 2289 | 195 | 6569 | 197 | 0719 | 199 |
| 46 | 8367 | 195 | 3063 | 196 | 7615 | 198 | 2028 | 199 | 6306 | 202 | 0454 | 203 |
| 47 | 8114 | 199 | 2807 | 200 | 7357 | 202 | 1767 | 204 | 6043 | 206 | 0188 | 207 |
| 48 | 7860 | 203 | 2551 | 204 | 7098 | 207 | 1506 | 208 | 5779 | 210 | 409923 | 212 |
| 49 | 7606 | 207 | 2294 | 208 | 6839 | 211 | 1245 | 212 | 5516 | 215 | 9658 | 216 |
| 50 | 7352 | 212 | 2038 | 213 | 6580 | 215 | 0984 | 217 | 5253 | 219 | 9392 | 221 |
| 51 | 487098 | 216 | 471782 | 217 | 456322 | 220 | 440723 | 221 | 424990 | 224 | 409127 | 225 |
| 52 | 6844 | 220 | 1525 | 221 | 6063 | 224 | 0462 | 226 | 4726 | 228 | 8862 | 230 |
| 53 | 6590 | 224 | 1269 | 225 | 5804 | 228 | 0200 | 230 | 4463 | 232 | 8596 | 234 |
| 54 | 6335 | 229 | 1012 | 230 | 5545 | 233 | 439939 | 234 | 4199 | 237 | 8331 | 239 |
| 55 | 6081 | 233 | 0755 | 234 | 5286 | 237 | 9678 | 239 | 3936 | 241 | 8065 | 243 |
| 56 | 5827 | 237 | 0499 | 238 | 5027 | 241 | 9417 | 243 | 3673 | 245 | 7799 | 247 |
| 57 | 5573 | 241 | 0242 | 242 | 4768 | 246 | 9155 | 247 | 3409 | 250 | 7534 | 252 |
| 58 | 5318 | 245 | 469985 | 247 | 4509 | 250 | 8894 | 251 | 3146 | 254 | 7268 | 256 |
| 59 | 5064 | 249 | 9728 | 251 | 4250 | 254 | 8633 | 256 | 2882 | 259 | 7002 | 260 |
| 60 | 4810 | 254 | 9472 | 256 | 3991 | 258 | 8371 | 260 | 2618 | 263 | 6737 | 265 |

TABLE XXVIII.—(*continued*).

| ′ ″ | 66° Co-sine. | 66° Parts for ″ | 67° Co-sine. | 67° Parts for ″ | 68° Co-sine. | 68° Parts for ″ | 69° Co-sine. | 69° Parts for ″ | 70° Co-sine. | 70° Parts for ″ | 71° Co-sine. | 71° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 406737 | 0 | 390731 | 0 | 374607 | 0 | 358368 | 0 | 342020 | 0 | 325568 | 0 |
| 1 | 6471 | 4 | 0463 | 4 | 4337 | 5 | 8096 | 5 | 1747 | 5 | 5293 | 5 |
| 2 | 6205 | 9 | 0196 | 9 | 4067 | 9 | 7825 | 9 | 1473 | 9 | 5018 | 9 |
| 3 | 5939 | 13 | 389928 | 13 | 3797 | 14 | 7553 | 14 | 1200 | 14 | 4743 | 14 |
| 4 | 5673 | 18 | 9660 | 18 | 3528 | 18 | 7281 | 18 | 0927 | 18 | 4468 | 18 |
| 5 | 5408 | 22 | 9392 | 22 | 3258 | 23 | 7010 | 23 | 0653 | 23 | 4193 | 23 |
| 6 | 5142 | 27 | 9124 | 27 | 2988 | 27 | 6738 | 27 | 0380 | 27 | 3917 | 27 |
| 7 | 4876 | 31 | 8856 | 31 | 2718 | 32 | 6466 | 32 | 0106 | 32 | 3642 | 32 |
| 8 | 4610 | 36 | 8588 | 36 | 2448 | 36 | 6194 | 36 | 339833 | 36 | 3367 | 37 |
| 9 | 4344 | 40 | 8320 | 40 | 2178 | 41 | 5923 | 41 | 9559 | 41 | 3092 | 41 |
| 10 | 4078 | 44 | 8052 | 45 | 1908 | 45 | 5651 | 46 | 9285 | 46 | 2816 | 46 |
| 11 | 403811 | 49 | 387784 | 49 | 371638 | 50 | 355379 | 50 | 339012 | 50 | 322541 | 51 |
| 12 | 3545 | 53 | 7516 | 54 | 1368 | 54 | 5107 | 54 | 8738 | 55 | 2266 | 55 |
| 13 | 3279 | 58 | 7247 | 58 | 1098 | 59 | 4835 | 59 | 8464 | 59 | 1990 | 60 |
| 14 | 3013 | 62 | 6979 | 63 | 0828 | 63 | 4563 | 63 | 8191 | 64 | 1715 | 64 |
| 15 | 2747 | 66 | 6711 | 67 | 0557 | 68 | 4291 | 68 | 7917 | 68 | 1440 | 69 |
| 16 | 2480 | 71 | 6443 | 72 | 0287 | 72 | 4019 | 73 | 7643 | 73 | 1164 | 74 |
| 17 | 2214 | 76 | 6174 | 76 | 0017 | 77 | 3747 | 77 | 7369 | 78 | 0889 | 78 |
| 18 | 1948 | 80 | 5906 | 81 | 369747 | 81 | 3475 | 82 | 7095 | 82 | 0613 | 83 |
| 19 | 1681 | 85 | 5638 | 85 | 9477 | 86 | 3203 | 87 | 6821 | 87 | 0337 | 87 |
| 20 | 1415 | 89 | 5369 | 89 | 9206 | 90 | 2931 | 91 | 6548 | 91 | 0062 | 92 |
| 21 | 401149 | 94 | 385101 | 93 | 368936 | 95 | 352658 | 96 | 336274 | 96 | 319786 | 96 |
| 22 | 0882 | 98 | 4832 | 98 | 8665 | 100 | 2386 | 100 | 6000 | 100 | 9511 | 101 |
| 23 | 0616 | 103 | 4564 | 102 | 8395 | 104 | 2114 | 105 | 5726 | 105 | 9235 | 106 |
| 24 | 0349 | 107 | 4295 | 107 | 8125 | 108 | 1842 | 109 | 5452 | 109 | 8959 | 110 |
| 25 | 0083 | 112 | 4027 | 111 | 7854 | 113 | 1569 | 114 | 5178 | 114 | 8684 | 115 |
| 26 | 399816 | 116 | 3758 | 116 | 7584 | 117 | 1297 | 118 | 4903 | 118 | 8408 | 119 |
| 27 | 9549 | 121 | 3490 | 121 | 7313 | 122 | 1025 | 123 | 4629 | 123 | 8132 | 124 |
| 28 | 9283 | 125 | 3221 | 125 | 7043 | 126 | 0752 | 127 | 4355 | 127 | 7856 | 128 |
| 29 | 9016 | 129 | 2952 | 130 | 6772 | 131 | 0480 | 132 | 4081 | 132 | 7581 | 133 |
| 30 | 8749 | 133 | 2683 | 134 | 6501 | 135 | 0207 | 136 | 3807 | 137 | 7305 | 138 |
| 31 | 398482 | 138 | 382415 | 139 | 366231 | 140 | 349935 | 141 | 333533 | 142 | 317029 | 143 |
| 32 | 8216 | 142 | 2146 | 143 | 5960 | 144 | 9662 | 145 | 3258 | 146 | 6753 | 147 |
| 33 | 7949 | 147 | 1877 | 148 | 5689 | 149 | 9390 | 150 | 2984 | 151 | 6477 | 152 |
| 34 | 7682 | 151 | 1608 | 152 | 5418 | 153 | 9117 | 155 | 2710 | 155 | 6201 | 157 |
| 35 | 7415 | 156 | 1339 | 157 | 5148 | 158 | 8845 | 159 | 2436 | 160 | 5925 | 161 |
| 36 | 7148 | 160 | 1070 | 161 | 4877 | 162 | 8572 | 164 | 2161 | 165 | 5649 | 166 |
| 37 | 6881 | 165 | 0801 | 166 | 4606 | 167 | 8299 | 168 | 1887 | 169 | 5373 | 171 |
| 38 | 6614 | 169 | 0532 | 170 | 4335 | 171 | 8027 | 173 | 1612 | 173 | 5097 | 175 |
| 39 | 6347 | 174 | 0263 | 175 | 4064 | 176 | 7754 | 177 | 1338 | 178 | 4821 | 180 |
| 40 | 6080 | 178 | 379994 | 179 | 3793 | 180 | 7481 | 182 | 1063 | 183 | 4545 | 184 |
| 41 | 395813 | 182 | 379725 | 184 | 363522 | 185 | 347209 | 186 | 330789 | 187 | 314269 | 189 |
| 42 | 5546 | 187 | 9456 | 188 | 3251 | 189 | 6936 | 191 | 0514 | 192 | 3993 | 193 |
| 43 | 5278 | 191 | 9187 | 193 | 2980 | 194 | 6663 | 195 | 0240 | 197 | 3716 | 198 |
| 44 | 5011 | 196 | 8918 | 197 | 2709 | 198 | 6390 | 200 | 329965 | 201 | 3440 | 202 |
| 45 | 4744 | 200 | 8649 | 202 | 2438 | 203 | 6117 | 205 | 9691 | 206 | 3164 | 207 |
| 46 | 4477 | 205 | 8379 | 206 | 2167 | 207 | 5844 | 209 | 9416 | 210 | 2888 | 212 |
| 47 | 4209 | 209 | 8110 | 211 | 1896 | 212 | 5571 | 214 | 9141 | 215 | 2611 | 216 |
| 48 | 3942 | 214 | 7841 | 215 | 1625 | 216 | 5298 | 218 | 8867 | 220 | 2335 | 221 |
| 49 | 3675 | 218 | 7571 | 220 | 1353 | 221 | 5025 | 223 | 8592 | 224 | 2059 | 225 |
| 50 | 3407 | 223 | 7302 | 224 | 1082 | 226 | 4752 | 228 | 8317 | 229 | 1782 | 230 |
| 51 | 393140 | 227 | 377033 | 229 | 360811 | 230 | 344479 | 232 | 328042 | 234 | 311506 | 235 |
| 52 | 2872 | 231 | 6763 | 233 | 0540 | 235 | 4206 | 237 | 7768 | 238 | 1229 | 239 |
| 53 | 2605 | 236 | 6494 | 238 | 0268 | 239 | 3933 | 241 | 7493 | 243 | 0953 | 244 |
| 54 | 2337 | 240 | 6224 | 242 | 359997 | 244 | 3660 | 246 | 7218 | 247 | 0676 | 248 |
| 55 | 2070 | 245 | 5955 | 247 | 9725 | 248 | 3387 | 250 | 6943 | 252 | 0400 | 253 |
| 56 | 1802 | 249 | 5685 | 251 | 9454 | 253 | 3113 | 255 | 6668 | 256 | 0123 | 258 |
| 57 | 1534 | 254 | 5416 | 256 | 9183 | 257 | 2840 | 259 | 6393 | 261 | 309847 | 262 |
| 58 | 1267 | 258 | 5146 | 260 | 8911 | 262 | 2567 | 264 | 6118 | 265 | 9570 | 267 |
| 59 | 0999 | 263 | 4876 | 265 | 8640 | 266 | 2294 | 268 | 5843 | 270 | 9294 | 271 |
| 60 | 0731 | 267 | 4607 | 269 | 8368 | 271 | 2020 | 273 | 5568 | 274 | 9017 | 276 |

## TABLE XXVIII.—(*continued*).

| ′ / ″ | 72° Co-sine. | 72° Parts for ″ | 73° Co-sine. | 73° Parts for ″ | 74° Co-sine. | 74° Parts for ″ | 75° Co-sine. | 75° Parts for ″ | 76° Co-sine. | 76° Parts for ″ | 77° Co-sine. | 77° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 309017 | 0 | 292372 | 0 | 275637 | 0 | 258819 | 0 | 241922 | 0 | 224951 | 0 |
| 1 | 8740 | 5 | 2094 | 5 | 5358 | 5 | 8538 | 5 | 1640 | 5 | 4668 | 5 |
| 2 | 8464 | 9 | 1815 | 9 | 5078 | 9 | 8257 | 9 | 1357 | 9 | 4381 | 9 |
| 3 | 8187 | 14 | 1537 | 14 | 4798 | 14 | 7976 | 14 | 1075 | 14 | 4101 | 14 |
| 4 | 7910 | 18 | 1259 | 19 | 4519 | 19 | 7695 | 19 | 0793 | 19 | 3817 | 19 |
| 5 | 7633 | 23 | 0981 | 23 | 4239 | 23 | 7414 | 23 | 0510 | 24 | 3534 | 24 |
| 6 | 7357 | 28 | 0702 | 28 | 3959 | 28 | 7133 | 28 | 0228 | 28 | 3250 | 28 |
| 7 | 7080 | 32 | 0424 | 32 | 3679 | 33 | 6852 | 33 | 239946 | 33 | 2967 | 33 |
| 8 | 6803 | 37 | 0146 | 37 | 3400 | 37 | 6571 | 37 | 9663 | 38 | 2683 | 38 |
| 9 | 6526 | 42 | 289867 | 42 | 3120 | 42 | 6289 | 42 | 9381 | 43 | 2399 | 43 |
| 10 | 6249 | 46 | 9589 | 46 | 2840 | 47 | 6008 | 47 | 9098 | 47 | 2116 | 47 |
| 11 | 305972 | 51 | 289310 | 51 | 272560 | 51 | 255727 | 52 | 238816 | 52 | 221832 | 52 |
| 12 | 5695 | 55 | 9032 | 56 | 2280 | 56 | 5446 | 56 | 8534 | 57 | 1549 | 57 |
| 13 | 5418 | 60 | 8753 | 60 | 2000 | 61 | 5165 | 61 | 8251 | 61 | 1265 | 62 |
| 14 | 5141 | 65 | 8475 | 65 | 1720 | 65 | 4883 | 66 | 7968 | 66 | 0981 | 66 |
| 15 | 4864 | 69 | 8196 | 70 | 1440 | 70 | 4602 | 70 | 7686 | 71 | 0697 | 71 |
| 16 | 4587 | 74 | 7918 | 74 | 1161 | 75 | 4321 | 75 | 7403 | 75 | 0414 | 76 |
| 17 | 4310 | 78 | 7639 | 79 | 0881 | 79 | 4039 | 80 | 7121 | 80 | 0130 | 81 |
| 18 | 4033 | 83 | 7361 | 84 | 0600 | 84 | 3758 | 84 | 6838 | 85 | 219846 | 85 |
| 19 | 3756 | 88 | 7082 | 88 | 0320 | 89 | 3477 | 89 | 6556 | 90 | 9562 | 90 |
| 20 | 3479 | 92 | 6803 | 93 | 0040 | 93 | 3195 | 94 | 6273 | 94 | 9279 | 95 |
| 21 | 303202 | 97 | 286525 | 98 | 269760 | 98 | 252914 | 98 | 235990 | 99 | 218995 | 100 |
| 22 | 2924 | 102 | 6246 | 102 | 9480 | 103 | 2632 | 103 | 5708 | 104 | 8711 | 104 |
| 23 | 2647 | 106 | 5967 | 107 | 9200 | 107 | 2351 | 108 | 5425 | 109 | 8427 | 109 |
| 24 | 2370 | 111 | 5688 | 112 | 8920 | 112 | 2069 | 113 | 5142 | 113 | 8143 | 114 |
| 25 | 2093 | 116 | 5410 | 116 | 8640 | 117 | 1788 | 117 | 4859 | 118 | 7859 | 119 |
| 26 | 1815 | 120 | 5131 | 121 | 8359 | 121 | 1506 | 122 | 4577 | 123 | 7575 | 123 |
| 27 | 1538 | 125 | 4852 | 126 | 8079 | 126 | 1225 | 127 | 4294 | 127 | 7292 | 128 |
| 28 | 1261 | 130 | 4573 | 130 | 7799 | 131 | 0943 | 131 | 4011 | 132 | 7008 | 133 |
| 29 | 0983 | 134 | 4294 | 135 | 7519 | 135 | 0662 | 136 | 3728 | 137 | 6724 | 138 |
| 30 | 0706 | 139 | 4015 | 139 | 7238 | 140 | 0380 | 141 | 3445 | 141 | 6440 | 142 |
| 31 | 300428 | 143 | 283736 | 144 | 266958 | 145 | 250098 | 146 | 233163 | 146 | 216156 | 147 |
| 32 | 0151 | 148 | 3458 | 149 | 6678 | 150 | 249817 | 150 | 2880 | 151 | 5872 | 152 |
| 33 | 299873 | 153 | 3179 | 154 | 6397 | 154 | 9535 | 155 | 2597 | 156 | 5588 | 157 |
| 34 | 9596 | 157 | 2900 | 158 | 6117 | 159 | 9253 | 160 | 2314 | 161 | 5304 | 161 |
| 35 | 9318 | 162 | 2621 | 163 | 5837 | 164 | 8972 | 165 | 2031 | 165 | 5019 | 166 |
| 36 | 9041 | 167 | 2342 | 168 | 5556 | 169 | 8690 | 169 | 1748 | 170 | 4735 | 171 |
| 37 | 8763 | 171 | 2062 | 172 | 5276 | 173 | 8408 | 174 | 1465 | 175 | 4451 | 176 |
| 38 | 8486 | 176 | 1783 | 177 | 4995 | 178 | 8126 | 179 | 1182 | 179 | 4167 | 180 |
| 39 | 8208 | 181 | 1504 | 182 | 4715 | 183 | 7845 | 183 | 0899 | 184 | 3883 | 185 |
| 40 | 7930 | 185 | 1225 | 186 | 4434 | 187 | 7563 | 188 | 0616 | 189 | 3599 | 190 |
| 41 | 297653 | 190 | 280946 | 191 | 264154 | 192 | 247281 | 193 | 230333 | 194 | 213315 | 195 |
| 42 | 7375 | 195 | 0667 | 196 | 3873 | 197 | 6999 | 198 | 0050 | 198 | 3030 | 199 |
| 43 | 7097 | 199 | 0388 | 200 | 3593 | 201 | 6717 | 202 | 229767 | 203 | 2746 | 204 |
| 44 | 6819 | 204 | 0108 | 205 | 3312 | 206 | 6435 | 207 | 9484 | 208 | 2462 | 209 |
| 45 | 6542 | 208 | 279829 | 210 | 3031 | 211 | 6153 | 212 | 9200 | 213 | 2178 | 213 |
| 46 | 6264 | 213 | 9550 | 214 | 2751 | 215 | 5871 | 216 | 8917 | 217 | 1893 | 218 |
| 47 | 5986 | 218 | 9270 | 219 | 2470 | 220 | 5589 | 221 | 8634 | 222 | 1609 | 223 |
| 48 | 5708 | 222 | 8991 | 224 | 2189 | 225 | 5307 | 225 | 8351 | 227 | 1325 | 228 |
| 49 | 5430 | 227 | 8712 | 228 | 1909 | 230 | 5025 | 230 | 8068 | 232 | 1040 | 232 |
| 50 | 5152 | 231 | 8432 | 233 | 1628 | 234 | 4743 | 235 | 7784 | 236 | 0756 | 237 |
| 51 | 294874 | 236 | 278153 | 238 | 261347 | 239 | 244461 | 240 | 227501 | 241 | 210472 | 242 |
| 52 | 4596 | 241 | 7874 | 242 | 1066 | 244 | 4179 | 245 | 7218 | 246 | 0187 | 247 |
| 53 | 4318 | 245 | 7594 | 247 | 0785 | 248 | 3897 | 249 | 6935 | 250 | 209903 | 251 |
| 54 | 4040 | 250 | 7315 | 252 | 0505 | 253 | 3615 | 254 | 6651 | 255 | 9619 | 256 |
| 55 | 3762 | 254 | 7035 | 256 | 0224 | 258 | 3333 | 259 | 6368 | 260 | 9334 | 261 |
| 56 | 3484 | 259 | 6756 | 261 | 259943 | 262 | 3051 | 263 | 6085 | 265 | 9050 | 266 |
| 57 | 3206 | 264 | 6476 | 266 | 9662 | 267 | 2769 | 268 | 5801 | 269 | 8765 | 270 |
| 58 | 2928 | 268 | 6197 | 270 | 9381 | 272 | 2486 | 273 | 5518 | 274 | 8481 | 275 |
| 59 | 2650 | 273 | 5917 | 275 | 9100 | 276 | 2204 | 277 | 5235 | 279 | 8196 | 280 |
| 60 | 2372 | 277 | 5637 | 279 | 8819 | 281 | 1922 | 282 | 4951 | 283 | 7912 | 284 |

## TABLE XXVIII.—(*continued*).

| ′ | 78° | | 79° | | 80° | | 81° | | 82° | | 83° | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ | Co-sine. | Parts for ″ |
| 0 | 207912 | 0 | 190809 | 0 | 173648 | 0 | 156435 | 0 | 139173 | 0 | 121869 | 0 |
| 1 | 7627 | 5 | 0523 | 5 | 3362 | 5 | 6147 | 5 | 8885 | 5 | 1581 | 5 |
| 2 | 7343 | 9 | 0238 | 10 | 3075 | 10 | 5860 | 10 | 8597 | 10 | 1292 | 10 |
| 3 | 7058 | 14 | 189952 | 14 | 2789 | 14 | 5573 | 14 | 8309 | 14 | 1003 | 14 |
| 4 | 6773 | 19 | 9667 | 19 | 2502 | 19 | 5285 | 19 | 8021 | 19 | 0714 | 19 |
| 5 | 6489 | 24 | 9381 | 24 | 2216 | 24 | 4998 | 24 | 7733 | 24 | 0426 | 24 |
| 6 | 6204 | 28 | 9095 | 29 | 1929 | 29 | 4710 | 29 | 7445 | 29 | 0137 | 29 |
| 7 | 5920 | 33 | 8810 | 33 | 1643 | 33 | 4423 | 33 | 7156 | 34 | 119848 | 34 |
| 8 | 5635 | 38 | 8524 | 38 | 1356 | 38 | 4136 | 38 | 6868 | 38 | 9559 | 39 |
| 9 | 5350 | 43 | 8239 | 43 | 1069 | 43 | 3848 | 43 | 6580 | 43 | 9270 | 43 |
| 10 | 5066 | 47 | 7953 | 48 | 0783 | 48 | 3561 | 48 | 6292 | 48 | 8982 | 48 |
| 11 | 204781 | 52 | 187667 | 52 | 170496 | 52 | 153273 | 53 | 136004 | 53 | 118693 | 53 |
| 12 | 4496 | 57 | 7381 | 57 | 0210 | 57 | 2986 | 57 | 5716 | 58 | 8404 | 58 |
| 13 | 4211 | 62 | 7096 | 62 | 169923 | 62 | 2698 | 62 | 5427 | 62 | 8115 | 63 |
| 14 | 3927 | 66 | 6810 | 67 | 9636 | 67 | 2411 | 67 | 5139 | 67 | 7826 | 67 |
| 15 | 3642 | 71 | 6524 | 71 | 9350 | 72 | 2123 | 72 | 4851 | 72 | 7537 | 72 |
| 16 | 3357 | 76 | 6238 | 76 | 9063 | 76 | 1836 | 77 | 4563 | 77 | 7249 | 77 |
| 17 | 3072 | 81 | 5952 | 81 | 8776 | 81 | 1548 | 81 | 4274 | 82 | 6960 | 82 |
| 18 | 2787 | 85 | 5667 | 86 | 8489 | 86 | 1261 | 86 | 3986 | 86 | 6671 | 87 |
| 19 | 2502 | 90 | 5381 | 91 | 8203 | 91 | 0973 | 91 | 3698 | 91 | 6382 | 91 |
| 20 | 2218 | 95 | 5095 | 95 | 7916 | 96 | 0686 | 96 | 3410 | 96 | 6093 | 96 |
| 21 | 201933 | 100 | 184809 | 100 | 167629 | 100 | 150398 | 101 | 133121 | 101 | 115804 | 101 |
| 22 | 1648 | 104 | 4523 | 105 | 7342 | 105 | 0111 | 106 | 2833 | 106 | 5515 | 106 |
| 23 | 1363 | 109 | 4237 | 110 | 7056 | 110 | 149823 | 111 | 2545 | 110 | 5226 | 111 |
| 24 | 1078 | 114 | 3951 | 115 | 6769 | 115 | 9535 | 116 | 2256 | 115 | 4937 | 116 |
| 25 | 0793 | 119 | 3665 | 119 | 6482 | 119 | 9248 | 120 | 1968 | 120 | 4648 | 120 |
| 26 | 0508 | 123 | 3380 | 124 | 6195 | 124 | 8960 | 125 | 1680 | 125 | 4359 | 125 |
| 27 | 0223 | 128 | 3094 | 129 | 5908 | 129 | 8672 | 130 | 1391 | 130 | 4070 | 130 |
| 28 | 199938 | 133 | 2808 | 134 | 5621 | 134 | 8385 | 135 | 1103 | 134 | 3781 | 135 |
| 29 | 9653 | 138 | 2522 | 138 | 5335 | 138 | 8097 | 140 | 0815 | 139 | 3492 | 140 |
| 30 | 9368 | 143 | 2236 | 143 | 5048 | 143 | 7809 | 144 | 0526 | 144 | 3203 | 144 |
| 31 | 199083 | 147 | 181950 | 148 | 164761 | 148 | 147522 | 149 | 130238 | 149 | 112914 | 149 |
| 32 | 8798 | 152 | 1664 | 153 | 4474 | 153 | 7234 | 153 | 129949 | 154 | 2625 | 154 |
| 33 | 8513 | 157 | 1377 | 157 | 4187 | 158 | 6946 | 158 | 9661 | 159 | 2336 | 159 |
| 34 | 8228 | 162 | 1091 | 162 | 3900 | 163 | 6659 | 163 | 9373 | 163 | 2047 | 164 |
| 35 | 7943 | 166 | 0805 | 167 | 3613 | 167 | 6371 | 168 | 9084 | 168 | 1758 | 169 |
| 36 | 7657 | 171 | 0519 | 172 | 3326 | 172 | 6083 | 172 | 8796 | 173 | 1469 | 174 |
| 37 | 7372 | 176 | 0233 | 176 | 3039 | 177 | 5795 | 177 | 8507 | 178 | 1180 | 179 |
| 38 | 7087 | 181 | 179947 | 181 | 2752 | 182 | 5508 | 182 | 8219 | 183 | 0891 | 184 |
| 39 | 6802 | 185 | 9661 | 186 | 2465 | 187 | 5220 | 187 | 7930 | 187 | 0602 | 189 |
| 40 | 6517 | 190 | 9375 | 191 | 2178 | 191 | 4932 | 192 | 7642 | 192 | 0313 | 193 |
| 41 | 196231 | 195 | 179088 | 195 | 161891 | 196 | 144644 | 196 | 127353 | 197 | 110023 | 198 |
| 42 | 5946 | 200 | 8802 | 200 | 1604 | 201 | 4356 | 201 | 7065 | 202 | 109734 | 203 |
| 43 | 5661 | 205 | 8516 | 205 | 1317 | 206 | 4068 | 206 | 6776 | 207 | 9445 | 208 |
| 44 | 5376 | 209 | 8230 | 210 | 1030 | 210 | 3781 | 211 | 6488 | 212 | 9156 | 212 |
| 45 | 5090 | 214 | 7944 | 214 | 0743 | 215 | 3493 | 215 | 6199 | 216 | 8867 | 217 |
| 46 | 4805 | 219 | 7657 | 219 | 0456 | 220 | 3205 | 220 | 5910 | 221 | 8578 | 222 |
| 47 | 4520 | 224 | 7371 | 224 | 0168 | 225 | 2917 | 225 | 5622 | 226 | 8289 | 227 |
| 48 | 4234 | 228 | 7085 | 229 | 159881 | 230 | 2629 | 230 | 5333 | 231 | 7999 | 231 |
| 49 | 3949 | 233 | 6798 | 234 | 9594 | 234 | 2341 | 235 | 5045 | 236 | 7710 | 236 |
| 50 | 3664 | 238 | 6512 | 238 | 9307 | 239 | 2053 | 240 | 4756 | 240 | 7421 | 241 |
| 51 | 193378 | 243 | 176226 | 243 | 159020 | 244 | 141765 | 244 | 124467 | 245 | 107132 | 246 |
| 52 | 3093 | 247 | 5940 | 248 | 8733 | 249 | 1477 | 249 | 4179 | 250 | 6843 | 250 |
| 53 | 2807 | 252 | 5653 | 253 | 8445 | 254 | 1189 | 254 | 3890 | 255 | 6553 | 255 |
| 54 | 2522 | 257 | 5367 | 257 | 8158 | 258 | 0901 | 259 | 3602 | 260 | 6264 | 260 |
| 55 | 2237 | 262 | 5080 | 262 | 7871 | 263 | 0613 | 264 | 3313 | 264 | 5975 | 265 |
| 56 | 1951 | 267 | 4794 | 267 | 7584 | 268 | 0325 | 268 | 3024 | 269 | 5686 | 270 |
| 57 | 1666 | 271 | 4508 | 272 | 7296 | 273 | 0037 | 273 | 2736 | 274 | 5396 | 275 |
| 58 | 1380 | 276 | 4221 | 276 | 7009 | 277 | 139749 | 278 | 2447 | 279 | 5107 | 279 |
| 59 | 1095 | 281 | 3935 | 281 | 6722 | 282 | 9461 | 283 | 2158 | 284 | 4818 | 284 |
| 60 | 0809 | 285 | 3648 | 286 | 6435 | 287 | 9173 | 287 | 1869 | 288 | 4529 | 289 |

TABLE XXVIII.—(*continued*).

| ′ ″ | 84° Co-sine. | 84° Parts for ″ | 85° Co-sine. | 85° Parts for ″ | 86° Co-sine. | 86° Parts for ″ | 87° Co-sine. | 87° Parts for ″ | 88° Co-sine. | 88° Parts for ″ | 89° Co-sine. | 89° Parts for ″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 104529 | 0 | 087156 | 0 | 069757 | 0 | 052336 | 0 | 034899 | 0 | 017452 | 0 |
| 1 | 4239 | 5 | 6866 | 5 | 9466 | 5 | 2046 | 5 | 4609 | 5 | 7162 | 5 |
| 2 | 3950 | 10 | 6576 | 10 | 9176 | 10 | 1755 | 10 | 4318 | 10 | 6871 | 10 |
| 3 | 3661 | 15 | 6286 | 15 | 8886 | 15 | 1465 | 15 | 4027 | 15 | 6580 | 15 |
| 4 | 3371 | 19 | 5997 | 19 | 8596 | 19 | 1174 | 19 | 3737 | 19 | 6289 | 19 |
| 5 | 3082 | 24 | 5707 | 24 | 8306 | 24 | 0884 | 24 | 3446 | 24 | 5998 | 24 |
| 6 | 2792 | 29 | 5417 | 29 | 8015 | 29 | 0593 | 29 | 3155 | 29 | 5707 | 29 |
| 7 | 2503 | 34 | 5127 | 34 | 7725 | 34 | 0302 | 34 | 2864 | 34 | 5417 | 34 |
| 8 | 2214 | 39 | 4837 | 39 | 7435 | 39 | 0012 | 39 | 2574 | 39 | 5126 | 39 |
| 9 | 1925 | 44 | 4547 | 44 | 7145 | 44 | 049721 | 44 | 2283 | 44 | 4835 | 44 |
| 10 | 1635 | 48 | 4258 | 48 | 6854 | 48 | 9431 | 48 | 1992 | 48 | 4544 | 49 |
| 11 | 101346 | 53 | 083968 | 53 | 066564 | 53 | 049140 | 53 | 031701 | 53 | 014253 | 53 |
| 12 | 1056 | 58 | 3678 | 58 | 6274 | 58 | 8850 | 58 | 1411 | 58 | 3962 | 58 |
| 13 | 0767 | 63 | 3388 | 63 | 5984 | 63 | 8559 | 63 | 1120 | 63 | 3671 | 63 |
| 14 | 0478 | 68 | 3098 | 68 | 5693 | 68 | 8269 | 68 | 0829 | 68 | 3381 | 68 |
| 15 | 0188 | 73 | 2808 | 73 | 5403 | 73 | 7978 | 73 | 0539 | 73 | 3090 | 73 |
| 16 | 099899 | 77 | 2518 | 77 | 5113 | 77 | 7688 | 77 | 0248 | 77 | 2799 | 78 |
| 17 | 9609 | 82 | 2228 | 82 | 4823 | 82 | 7397 | 82 | 029957 | 82 | 2508 | 83 |
| 18 | 9320 | 87 | 1939 | 87 | 4532 | 87 | 7107 | 87 | 9666 | 87 | 2217 | 87 |
| 19 | 9030 | 92 | 1649 | 92 | 4242 | 92 | 6816 | 92 | 9376 | 92 | 1926 | 92 |
| 20 | 8741 | 97 | 1359 | 97 | 3952 | 97 | 6525 | 97 | 9085 | 97 | 1635 | 97 |
| 21 | 098451 | 102 | 081069 | 102 | 063661 | 102 | 046235 | 102 | 028794 | 102 | 011344 | 102 |
| 22 | 8162 | 107 | 0779 | 107 | 3371 | 106 | 5944 | 106 | 8503 | 106 | 1054 | 107 |
| 23 | 7872 | 112 | 0489 | 112 | 3081 | 111 | 5654 | 111 | 8212 | 111 | 0763 | 112 |
| 24 | 7583 | 116 | 0199 | 116 | 2791 | 116 | 5363 | 116 | 7922 | 116 | 0472 | 116 |
| 25 | 7293 | 121 | 079909 | 121 | 2500 | 121 | 5072 | 121 | 7631 | 121 | 0181 | 121 |
| 26 | 7004 | 126 | 9619 | 126 | 2210 | 126 | 4782 | 126 | 7340 | 126 | 009890 | 126 |
| 27 | 6714 | 131 | 9329 | 131 | 1920 | 131 | 4491 | 131 | 7049 | 131 | 9599 | 131 |
| 28 | 6425 | 136 | 9039 | 136 | 1629 | 136 | 4201 | 136 | 6759 | 136 | 9308 | 136 |
| 29 | 6135 | 141 | 8749 | 141 | 1339 | 140 | 3910 | 140 | 6468 | 140 | 9017 | 141 |
| 30 | 5846 | 145 | 8459 | 145 | 1049 | 145 | 3619 | 145 | 6177 | 145 | 8726 | 145 |
| 31 | 095556 | 150 | 078169 | 150 | 060758 | 150 | 043329 | 150 | 025886 | 150 | 008436 | 150 |
| 32 | 5267 | 155 | 7879 | 155 | 0468 | 155 | 3038 | 155 | 5595 | 155 | 8145 | 155 |
| 33 | 4977 | 160 | 7589 | 160 | 0178 | 160 | 2748 | 160 | 5305 | 160 | 7854 | 160 |
| 34 | 4688 | 164 | 7299 | 164 | 059887 | 165 | 2457 | 165 | 5014 | 165 | 7563 | 165 |
| 35 | 4398 | 169 | 7009 | 169 | 9597 | 169 | 2166 | 169 | 4723 | 170 | 7272 | 170 |
| 36 | 4108 | 174 | 6719 | 174 | 9306 | 174 | 1876 | 174 | 4432 | 175 | 6981 | 175 |
| 37 | 3819 | 179 | 6429 | 179 | 9016 | 179 | 1585 | 179 | 4141 | 179 | 6690 | 179 |
| 38 | 3529 | 184 | 6139 | 184 | 8726 | 184 | 1294 | 184 | 3851 | 184 | 6400 | 184 |
| 39 | 3240 | 189 | 5849 | 189 | 8435 | 189 | 1004 | 189 | 3560 | 189 | 6109 | 189 |
| 40 | 2950 | 193 | 5559 | 193 | 8145 | 194 | 0713 | 194 | 3269 | 194 | 5818 | 194 |
| 41 | 092660 | 198 | 075269 | 198 | 057854 | 198 | 040422 | 198 | 022978 | 199 | 005527 | 139 |
| 42 | 2371 | 203 | 4979 | 203 | 7564 | 203 | 0132 | 203 | 2687 | 204 | 5236 | 204 |
| 43 | 2081 | 208 | 4689 | 208 | 7274 | 208 | 039841 | 208 | 2397 | 209 | 4945 | 209 |
| 44 | 1791 | 213 | 4399 | 213 | 6983 | 213 | 9551 | 213 | 2106 | 213 | 4654 | 213 |
| 45 | 1502 | 218 | 4109 | 218 | 6693 | 218 | 9260 | 218 | 1815 | 218 | 4363 | 218 |
| 46 | 1212 | 222 | 3818 | 222 | 6402 | 223 | 8969 | 223 | 1524 | 223 | 4072 | 223 |
| 47 | 0922 | 227 | 3528 | 227 | 6112 | 227 | 8679 | 227 | 1233 | 228 | 3782 | 228 |
| 48 | 0633 | 232 | 3238 | 232 | 5822 | 232 | 8388 | 232 | 0942 | 233 | 3491 | 233 |
| 49 | 0343 | 237 | 2948 | 237 | 5531 | 237 | 8097 | 237 | 0652 | 238 | 3200 | 238 |
| 50 | 0053 | 242 | 2658 | 242 | 5241 | 242 | 7807 | 242 | 0361 | 243 | 2909 | 243 |
| 51 | 089764 | 247 | 072368 | 247 | 054950 | 247 | 037516 | 247 | 020070 | 247 | 002618 | 247 |
| 52 | 9174 | 252 | 2078 | 252 | 4660 | 252 | 7225 | 252 | 019779 | 252 | 2327 | 252 |
| 53 | 9184 | 257 | 1788 | 257 | 4369 | 257 | 6934 | 257 | 9488 | 257 | 2036 | 257 |
| 54 | 8894 | 261 | 1497 | 261 | 4079 | 261 | 6644 | 261 | 9197 | 262 | 1745 | 262 |
| 55 | 8605 | 266 | 1207 | 266 | 3788 | 266 | 6353 | 266 | 8907 | 267 | 1454 | 267 |
| 56 | 8315 | 271 | 0917 | 271 | 3498 | 271 | 6062 | 271 | 8616 | 272 | 1164 | 272 |
| 57 | 8025 | 276 | 0627 | 276 | 3207 | 276 | 5772 | 276 | 8325 | 276 | 0873 | 276 |
| 58 | 7735 | 281 | 0337 | 281 | 2917 | 281 | 5481 | 281 | 8034 | 281 | 0582 | 281 |
| 59 | 7446 | 285 | 0047 | 285 | 2626 | 286 | 5190 | 286 | 7743 | 286 | 0291 | 286 |
| 60 | 7156 | 290 | 069757 | 290 | 2336 | 290 | 4899 | 290 | 7452 | 291 | 0000 | 291 |

## TABLE XXIX.

| ARC. | | | | | |
|---|---|---|---|---|---|
| ° | H.M. | ′ | M. S. | ″ | S. |
| 0 | 0 0 | 0 | 0 0 | 0 | 0·00 |
| 1 | 0 4 | 1 | 0 4 | 1 | 0·07 |
| 2 | 0 8 | 2 | 0 8 | 2 | 0·13 |
| 3 | 0 12 | 3 | 0 12 | 3 | 0·20 |
| 4 | 0 16 | 4 | 0 16 | 4 | 0·27 |
| 5 | 0 20 | 5 | 0 20 | 5 | 0·33 |
| 6 | 0 24 | 6 | 0 24 | 6 | 0·40 |
| 7 | 0 28 | 7 | 0 28 | 7 | 0·47 |
| 8 | 0 32 | 8 | 0 32 | 8 | 0·53 |
| 9 | 0 36 | 9 | 0 36 | 9 | 0·60 |
| 10 | 0 40 | 10 | 0 40 | 10 | 0·67 |
| 11 | 0 44 | 11 | 0 44 | 11 | 0·73 |
| 12 | 0 48 | 12 | 0 48 | 12 | 0·80 |
| 13 | 0 52 | 13 | 0 52 | 13 | 0·87 |
| 14 | 0 56 | 14 | 0 56 | 14 | 0·93 |
| 15 | 1 0 | 15 | 1 0 | 15 | 1·00 |
| 16 | 1 4 | 16 | 1 4 | 16 | 1·07 |
| 17 | 1 8 | 17 | 1 8 | 17 | 1·13 |
| 18 | 1 12 | 18 | 1 12 | 18 | 1·20 |
| 19 | 1 16 | 19 | 1 16 | 19 | 1·27 |
| 20 | 1 20 | 20 | 1 20 | 20 | 1·33 |
| 30 | 2 0 | 21 | 1 24 | 21 | 1·40 |
| 40 | 2 40 | 22 | 1 28 | 22 | 1·47 |
| 50 | 3 20 | 23 | 1 32 | 23 | 1·53 |
| 60 | 4 0 | 24 | 1 36 | 24 | 1·60 |
| 70 | 4 40 | 25 | 1 40 | 25 | 1·67 |
| 80 | 5 20 | 26 | 1 44 | 26 | 1·73 |
| 90 | 6 0 | 27 | 1 48 | 27 | 1·80 |
| 100 | 6 40 | 28 | 1 52 | 28 | 1·87 |
| 110 | 7 20 | 29 | 1 56 | 29 | 1·93 |
| 120 | 8 0 | 30 | 2 0 | 30 | 2·00 |
| 130 | 8 40 | 31 | 2 4 | 31 | 2·07 |
| 140 | 9 20 | 32 | 2 8 | 32 | 2·13 |
| 150 | 10 0 | 33 | 2 12 | 33 | 2·20 |
| 160 | 10 40 | 34 | 2 16 | 34 | 2·27 |
| 170 | 11 20 | 35 | 2 20 | 35 | 2·33 |
| 180 | 12 0 | 36 | 2 24 | 36 | 2·40 |
| | | 37 | 2 28 | 37 | 2·47 |
| | | 38 | 2 32 | 38 | 2·53 |
| | | 39 | 2 36 | 39 | 2·60 |
| | | 40 | 2 40 | 40 | 2·67 |
| | | 41 | 2 44 | 41 | 2·73 |
| | | 42 | 2 48 | 42 | 2·80 |
| | | 43 | 2 52 | 43 | 2·87 |
| | | 44 | 2 56 | 44 | 2·93 |
| | | 45 | 3 0 | 45 | 3·00 |
| | | 46 | 3 4 | 46 | 3·07 |
| | | 47 | 3 8 | 47 | 3·13 |
| | | 48 | 3 12 | 48 | 3·20 |
| | | 49 | 3 16 | 49 | 3·27 |
| | | 50 | 3 20 | 50 | 3·33 |
| | | 51 | 3 24 | 51 | 3·40 |
| | | 52 | 3 28 | 52 | 3·47 |
| | | 53 | 3 32 | 53 | 3·53 |
| | | 54 | 3 36 | 54 | 3·60 |
| | | 55 | 3 40 | 55 | 3·67 |
| | | 56 | 3 44 | 56 | 3·73 |
| | | 57 | 3 48 | 57 | 3·80 |
| | | 58 | 3 52 | 58 | 3·87 |
| | | 59 | 3 56 | 59 | 3·93 |

## TABLE XXX.

| TIME. | | | | | | | |
|---|---|---|---|---|---|---|---|
| H. | ° | M. | ° ′ | S. | ′ ″ | 10th | ″ |
| 0 | 0 | 0 | 0 0 | 0 | 0 0 | 0·0 | 0·0 |
| 1 | 15 | 1 | 0 15 | 1 | 0 15 | 0·1 | 1·5 |
| 2 | 30 | 2 | 0 30 | 2 | 0 30 | 0·2 | 3·0 |
| 3 | 45 | 3 | 0 45 | 3 | 0 45 | 0·3 | 4·5 |
| 4 | 60 | 4 | 1 0 | 4 | 1 0 | 0·4 | 6·0 |
| 5 | 75 | 5 | 1 15 | 5 | 1 15 | 0·5 | 7·5 |
| 6 | 90 | 6 | 1 30 | 6 | 1 30 | 0·6 | 9·0 |
| 7 | 105 | 7 | 1 45 | 7 | 1 45 | 0·7 | 10·5 |
| 8 | 120 | 8 | 2 0 | 8 | 2 0 | 0·8 | 12·0 |
| 9 | 135 | 9 | 2 15 | 9 | 2 15 | 0·9 | 13·5 |
| 10 | 150 | 10 | 2 30 | 10 | 2 30 | 1·0 | 15·0 |
| 11 | 165 | 11 | 2 45 | 11 | 2 45 | | |
| 12 | 180 | 12 | 3 0 | 12 | 3 0 | | |
| 13 | 195 | 13 | 3 15 | 13 | 3 15 | | |
| 14 | 210 | 14 | 3 30 | 14 | 3 30 | | |
| 15 | 225 | 15 | 3 45 | 15 | 3 45 | | |
| 16 | 240 | 16 | 4 0 | 16 | 4 0 | | |
| 17 | 255 | 17 | 4 15 | 17 | 4 15 | | |
| 18 | 270 | 18 | 4 30 | 18 | 4 30 | | |
| 19 | 285 | 19 | 4 45 | 19 | 4 45 | | |
| 20 | 300 | 20 | 5 0 | 20 | 5 0 | | |
| 21 | 315 | 21 | 5 15 | 21 | 5 15 | | |
| 22 | 330 | 22 | 5 30 | 22 | 5 30 | | |
| 23 | 345 | 23 | 5 45 | 23 | 5 45 | | |
| 24 | 360 | 24 | 6 0 | 24 | 6 0 | | |
| | | 25 | 6 15 | 25 | 6 15 | | |
| | | 26 | 6 30 | 26 | 6 30 | | |
| | | 27 | 6 45 | 27 | 6 45 | | |
| | | 28 | 7 0 | 28 | 7 0 | | |
| | | 29 | 7 15 | 29 | 7 15 | | |
| | | 30 | 7 30 | 30 | 7 30 | | |
| | | 31 | 7 45 | 31 | 7 45 | | |
| | | 32 | 8 0 | 32 | 8 0 | | |
| | | 33 | 8 15 | 33 | 8 15 | | |
| | | 34 | 8 30 | 34 | 8 30 | | |
| | | 35 | 8 45 | 35 | 8 45 | | |
| | | 36 | 9 0 | 36 | 9 0 | | |
| | | 37 | 9 15 | 37 | 9 15 | | |
| | | 38 | 9 30 | 38 | 9 30 | | |
| | | 39 | 9 45 | 39 | 9 45 | | |
| | | 40 | 10 0 | 40 | 10 0 | | |
| | | 41 | 10 15 | 41 | 10 15 | | |
| | | 42 | 10 30 | 42 | 10 30 | | |
| | | 43 | 10 45 | 43 | 10 45 | | |
| | | 44 | 11 0 | 44 | 11 0 | | |
| | | 45 | 11 15 | 45 | 11 15 | | |
| | | 46 | 11 30 | 46 | 11 30 | | |
| | | 47 | 11 45 | 47 | 11 45 | | |
| | | 48 | 12 0 | 48 | 12 0 | | |
| | | 49 | 12 15 | 49 | 12 15 | | |
| | | 50 | 12 30 | 50 | 12 30 | | |
| | | 51 | 12 45 | 51 | 12 45 | | |
| | | 52 | 13 0 | 52 | 13 0 | | |
| | | 53 | 13 15 | 53 | 13 15 | | |
| | | 54 | 13 30 | 54 | 13 30 | | |
| | | 55 | 13 45 | 55 | 13 45 | | |
| | | 56 | 14 0 | 56 | 14 0 | | |
| | | 57 | 14 15 | 57 | 14 15 | | |
| | | 58 | 14 30 | 58 | 14 30 | | |
| | | 59 | 14 45 | 59 | 14 45 | | |

## TABLE XXXI.

**ACCELERATION**

| H | M | S | M | S | S | Dec. |
|---|---|---|---|---|---|---|
| 1 | 0 | 9·86 | 1 | 0·16 | 1 | ·00 |
| 2 | 0 | 19·71 | 2 | 0·33 | 2 | ·00 |
| 3 | 0 | 29·57 | 3 | 0·49 | 3 | ·01 |
| 4 | 0 | 39·43 | 4 | 0·66 | 4 | ·01 |
| 5 | 0 | 49·28 | 5 | 0·82 | 5 | ·01 |
| 6 | 0 | 59·14 | 6 | 0·98 | 6 | ·02 |
| 7 | 1 | 9·00 | 7 | 1·15 | 7 | ·02 |
| 8 | 1 | 18·85 | 8 | 1·31 | 8 | ·02 |
| 9 | 1 | 28·71 | 9 | 1·48 | 9 | ·02 |
| 10 | 1 | 38·56 | 10 | 1·64 | 10 | ·03 |
| 11 | 1 | 48·42 | 11 | 1·81 | 11 | ·03 |
| 12 | 1 | 58·28 | 12 | 1·97 | 12 | ·03 |
| 13 | 2 | 8·13 | 13 | 2·13 | 13 | ·04 |
| 14 | 2 | 17·99 | 14 | 2·30 | 14 | ·04 |
| 15 | 2 | 27·85 | 15 | 2·46 | 15 | ·04 |
| 16 | 2 | 37·70 | 16 | 2·63 | 16 | ·04 |
| 17 | 2 | 47·56 | 17 | 2·79 | 17 | ·05 |
| 18 | 2 | 57·42 | 18 | 2·96 | 18 | ·05 |
| 19 | 3 | 7·27 | 19 | 3·12 | 19 | ·05 |
| 20 | 3 | 17·13 | 20 | 3·29 | 20 | ·05 |
| 21 | 3 | 26·99 | 21 | 3·45 | 21 | ·06 |
| 22 | 3 | 36·84 | 22 | 3·61 | 22 | ·06 |
| 23 | 3 | 46·70 | 23 | 3·78 | 23 | ·06 |
| 24 | 3 | 56·56 | 24 | 3·94 | 24 | ·07 |
| | | | 25 | 4·11 | 25 | ·07 |
| | | | 26 | 4·27 | 26 | ·07 |
| | | | 27 | 4·44 | 27 | ·07 |
| | | | 28 | 4·60 | 28 | ·08 |
| | | | 29 | 4·76 | 29 | ·08 |
| | | | 30 | 4·93 | 30 | ·08 |
| | | | 31 | 5·09 | 31 | ·08 |
| | | | 32 | 5·26 | 32 | ·09 |
| | | | 33 | 5·42 | 33 | ·09 |
| | | | 34 | 5·59 | 34 | ·09 |
| | | | 35 | 5·75 | 35 | ·10 |
| | | | 36 | 5·91 | 36 | ·10 |
| | | | 37 | 6·08 | 37 | ·10 |
| | | | 38 | 6·24 | 38 | ·11 |
| | | | 39 | 6·40 | 39 | ·11 |
| | | | 40 | 6·57 | 40 | ·11 |
| | | | 41 | 6·74 | 41 | ·11 |
| | | | 42 | 6·90 | 42 | ·12 |
| | | | 43 | 7·06 | 43 | ·12 |
| | | | 44 | 7·23 | 44 | ·12 |
| | | | 45 | 7·39 | 45 | ·12 |
| | | | 46 | 7·56 | 46 | ·13 |
| | | | 47 | 7·72 | 47 | ·13 |
| | | | 48 | 7·89 | 48 | ·13 |
| | | | 49 | 8·05 | 49 | ·14 |
| | | | 50 | 8·21 | 50 | ·14 |
| | | | 51 | 8·38 | 51 | ·14 |
| | | | 52 | 8·54 | 52 | ·14 |
| | | | 53 | 8·71 | 53 | ·15 |
| | | | 54 | 8·87 | 54 | ·15 |
| | | | 55 | 9·04 | 55 | ·15 |
| | | | 56 | 9·20 | 56 | ·15 |
| | | | 57 | 9·36 | 57 | ·16 |
| | | | 58 | 9·53 | 58 | ·16 |
| | | | 59 | 9·69 | 59 | ·16 |
| | | | 60 | 9·86 | 60 | ·16 |

## TABLE XXXII.

**RETARDATION**

| H | M | S | M | S | S | Dec. |
|---|---|---|---|---|---|---|
| 1 | 0 | 9·83 | 1 | 0·16 | 1 | ·00 |
| 2 | 0 | 19·66 | 2 | 0·33 | 2 | ·00 |
| 3 | 0 | 29·49 | 3 | 0·49 | 3 | ·01 |
| 4 | 0 | 39·32 | 4 | 0·66 | 4 | ·01 |
| 5 | 0 | 49·15 | 5 | 0·82 | 5 | ·01 |
| 6 | 0 | 58·98 | 6 | 0·98 | 6 | ·02 |
| 7 | 1 | 8·81 | 7 | 1·15 | 7 | ·02 |
| 8 | 1 | 18·64 | 8 | 1·31 | 8 | ·02 |
| 9 | 1 | 28·47 | 9 | 1·47 | 9 | ·02 |
| 10 | 1 | 38·30 | 10 | 1·64 | 10 | ·03 |
| 11 | 1 | 48·13 | 11 | 1·80 | 11 | ·03 |
| 12 | 1 | 57·95 | 12 | 1·97 | 12 | ·03 |
| 13 | 2 | 7·78 | 13 | 2·13 | 13 | ·04 |
| 14 | 2 | 17·61 | 14 | 2·29 | 14 | ·04 |
| 15 | 2 | 27·44 | 15 | 2·46 | 15 | ·04 |
| 16 | 2 | 37·27 | 16 | 2·62 | 16 | ·04 |
| 17 | 2 | 47·10 | 17 | 2·78 | 17 | ·05 |
| 18 | 2 | 56·93 | 18 | 2·95 | 18 | ·05 |
| 19 | 3 | 6·76 | 19 | 3·11 | 19 | ·05 |
| 20 | 3 | 16·59 | 20 | 3·28 | 20 | ·05 |
| 21 | 3 | 26·42 | 21 | 3·44 | 21 | ·06 |
| 22 | 3 | 36·25 | 22 | 3·60 | 22 | ·06 |
| 23 | 3 | 46·08 | 23 | 3·77 | 23 | ·06 |
| 24 | 3 | 55·91 | 24 | 3·93 | 24 | ·07 |
| | | | 25 | 4·10 | 25 | ·07 |
| | | | 26 | 4·26 | 26 | ·07 |
| | | | 27 | 4·42 | 27 | ·07 |
| | | | 28 | 4·59 | 28 | ·08 |
| | | | 29 | 4·75 | 29 | ·08 |
| | | | 30 | 4·91 | 30 | ·08 |
| | | | 31 | 5·08 | 31 | ·08 |
| | | | 32 | 5·24 | 32 | ·09 |
| | | | 33 | 5·41 | 33 | ·09 |
| | | | 34 | 5·57 | 34 | ·09 |
| | | | 35 | 5·73 | 35 | ·10 |
| | | | 36 | 5·90 | 36 | ·10 |
| | | | 37 | 6·06 | 37 | ·10 |
| | | | 38 | 6·23 | 38 | ·11 |
| | | | 39 | 6·39 | 30 | ·11 |
| | | | 40 | 6·55 | 40 | ·11 |
| | | | 41 | 6·72 | 41 | ·11 |
| | | | 42 | 6·88 | 42 | ·12 |
| | | | 43 | 7·04 | 43 | ·12 |
| | | | 44 | 7·21 | 44 | ·12 |
| | | | 45 | 7·37 | 45 | ·12 |
| | | | 46 | 7·54 | 46 | ·13 |
| | | | 47 | 7·70 | 47 | ·13 |
| | | | 48 | 7·86 | 48 | ·13 |
| | | | 49 | 8·03 | 49 | ·14 |
| | | | 50 | 8·19 | 50 | ·14 |
| | | | 51 | 8·36 | 51 | ·14 |
| | | | 52 | 8·52 | 52 | ·14 |
| | | | 53 | 8·68 | 53 | ·15 |
| | | | 54 | 8·85 | 54 | ·15 |
| | | | 55 | 9·01 | 55 | ·15 |
| | | | 56 | 9·17 | 56 | ·15 |
| | | | 57 | 9·34 | 57 | ·16 |
| | | | 58 | 9·50 | 58 | ·16 |
| | | | 59 | 9·67 | 59 | ·16 |
| | | | 60 | 9·83 | 60 | ·16 |

## TABLE XXXIII.

### PARALLAX IN ALTITUDE OF A PLANET

| Alt. | Planet's Horizontal Parallax | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1″ | 2″ | 3″ | 4″ | 5″ | 6″ | 7″ | 8″ | 9″ | 10″ | 20″ | 30″ |
| 5° | 1″0 | 2″0 | 3″0 | 4″0 | 5″0 | 6″0 | 7″0 | 8″0 | 9″0 | 10″0 | 19″9 | 29″9 |
| 10 | 1·0 | 2·0 | 2·9 | 3·9 | 4·9 | 5·9 | 6·9 | 7·9 | 8·9 | 9·8 | 19·7 | 29·5 |
| 15 | 1·0 | 2·0 | 2·9 | 3·8 | 4·8 | 5·8 | 6·8 | 7·7 | 8·7 | 9·7 | 19·3 | 29·0 |
| 20 | 0·9 | 1·9 | 2·8 | 3·7 | 4·6 | 5·6 | 6·5 | 7·5 | 8·5 | 9·4 | 18·8 | 28·2 |
| 25 | 0·9 | 1·9 | 2·7 | 3·6 | 4·5 | 5·4 | 6.3 | 7·3 | 8·2 | 9·1 | 18·1 | 27·2 |
| 30 | 0·9 | 1·8 | 2·6 | 3·5 | 4·3 | 5·2 | 6·1 | 7·0 | 7·8 | 8·7 | 17·3 | 26·0 |
| 35 | 0·8 | 1·6 | 2·5 | 3·3 | 4·1 | 4·9 | 5·7 | 6·6 | 7·4 | 8·2 | 16·4 | 24·6 |
| 40 | 0·8 | 1·5 | 2·3 | 3·1 | 3·8 | 4·6 | 5·4 | 6·1 | 6·9 | 7·7 | 15·3 | 23·0 |
| 45 | 0·7 | 1·4 | 2·1 | 2·8 | 3·5 | 4·2 | 4·9 | 5·7 | 6·4 | 7·1 | 14·1 | 21·2 |
| 50 | 0·7 | 1·3 | 2·0 | 2·5 | 3·2 | 3·9 | 4·5 | 5·1 | 5·8 | 6·4 | 12·9 | 19·3 |
| 55 | 0·6 | 1·1 | 1·7 | 2·3 | 2·8 | 3·4 | 4·0 | 4·6 | 5·2 | 5·7 | 11·5 | 17·2 |
| 60 | 0·5 | 1·0 | 1·5 | 2·0 | 2·5 | 3·0 | 3·5 | 4·0 | 4·5 | 5·0 | 10·0 | 15·0 |
| 62 | 0·5 | 0·9 | 1·4 | 1·9 | 2·3 | 2·8 | 3·3 | 3·8 | 4·2 | 4·7 | 9·4 | 14·1 |
| 64 | 0·4 | 0·9 | 1·3 | 1·8 | 2·2 | 2·6 | 3·1 | 3·5 | 3·9 | 4·4 | 8·8 | 13·1 |
| 66 | 0·4 | 0·8 | 1·2 | 1·6 | 2·0 | 2·4 | 2·8 | 3·3 | 3·7 | 4·1 | 8·1 | 12·2 |
| 68 | 0·4 | 0·7 | 1·1 | 1·5 | 1·8 | 2·2 | 2·6 | 3·0 | 3·4 | 3·7 | 7·5 | 11·2 |
| 70 | 0·3 | 0·7 | 1·0 | 1·4 | 1·7 | 2·1 | 2·4 | 2·7 | 3·1 | 3·4 | 6·8 | 10·3 |
| 72 | 0·3 | 0·6 | 0·9 | 1·2 | 1·5 | 1·9 | 2·2 | 2·5 | 2·8 | 3·1 | 6·2 | 9·3 |
| 74 | 0·3 | 0·6 | 0·8 | 1·1 | 1·3 | 1·7 | 1·9 | 2·2 | 2·5 | 2·7 | 5·5 | 8·3 |
| 76 | 0·2 | 0·5 | 0·7 | 0·9 | 1·2 | 1·5 | 1·7 | 1·9 | 2·2 | 2·4 | 4·8 | 7·3 |
| 78 | 0·2 | 0·4 | 0·6 | 0·8 | 1·0 | 1·2 | 1·4 | 1·7 | 1·9 | 2·1 | 4·2 | 6·2 |
| 80 | 0·2 | 0·3 | 0·5 | 0·7 | 0·8 | 1·0 | 1·2 | 1·4 | 1·6 | 1·7 | 3·5 | 5·2 |
| 82 | 0·1 | 0·3 | 0·4 | 0·6 | 0·7 | 0·8 | 1·0 | 1·1 | 1·2 | 1·4 | 2·8 | 4·2 |
| 84 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·6 | 0·7 | 0·8 | 0·9 | 1·0 | 2·1 | 3·1 |
| 86 | 0·1 | 0·1 | 0·2 | 0·3 | 0·3 | 0·4 | 0·5 | 0·6 | 0·6 | 0·7 | 1·4 | 2·1 |
| 88 | 0·0 | 0·1 | 0·1 | 0·1 | 0·1 | 0·2 | 0·2 | 0·3 | 0·3 | 0·3 | 0·7 | 1·0 |
| 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## TABLE XXXIV.

### CORRECTION OF THE MOON'S EQUATORIAL PARALLAX FOR THE FIGURE OF THE EARTH

(Compression $\frac{1}{300}$)

| Lat. | Horizontal Parallax | | | | |
|---|---|---|---|---|---|
| | 54′ | 56′ | 58′ | 60′ | 62′ |
| 0° | ″0 | ″0 | ″0 | ″0 | ″0 |
| 8 | 0·2 | 0·2 | 0·2 | 0·2 | 0·2 |
| 16 | 0·8 | 0·8 | 0·8 | 0·9 | 0·9 |
| 20 | 1·2 | 1·3 | 1·3 | 1·4 | 1·4 |
| 24 | 1·8 | 1·8 | 1·9 | 2·0 | 2·0 |
| 28 | 2·4 | 2·5 | 2·5 | 2·6 | 2·7 |
| 32 | 3·0 | 3·1 | 3·2 | 3·3 | 3·4 |
| 36 | 3·7 | 3·9 | 4·0 | 4·1 | 4·2 |
| 40 | 4·4 | 4·6 | 4·8 | 4·9 | 5·1 |
| 44 | 5·2 | 5·4 | 5·6 | 5·8 | 6·0 |
| 48 | 5·9 | 6·1 | 6·4 | 6·6 | 6·8 |
| 52 | 6·7 | 6·9 | 7·2 | 7·4 | 7·7 |
| 56 | 7·4 | 7·7 | 7·9 | 8·2 | 8·5 |
| 60 | 8·1 | 8·4 | 8·7 | 9·0 | 9·3 |
| 64 | 8·7 | 9·0 | 9·4 | 9·7 | 10·0 |
| 68 | 9·3 | 9·6 | 10·0 | 10·3 | 10·6 |
| 72 | 9·8 | 10·1 | 10·5 | 10·9 | 11·2 |
| 76 | 10·2 | 10·6 | 10·9 | 11·3 | 11·7 |
| 80 | 10·5 | 10·9 | 11·2 | 11·6 | 12·0 |

## TABLE XXXV.

**REDUCTION OF LATITUDE**
(Compression $\frac{1}{300}$).

| Lat. | Red. | Lat. | Red. | Lat. | Red. |
|---|---|---|---|---|---|
| 0° | 0′ 0″ | 30° | 9′ 55″ | 60° | 9′ 57″ |
| 1 | 0 24 | 31 | 10 7 | 61 | 9 45 |
| 2 | 0 48 | 32 | 10 18 | 62 | 9 32 |
| 3 | 1 12 | 33 | 10 28 | 63 | 9 18 |
| 4 | 1 35 | 34 | 10 38 | 64 | 9 4 |
| 5 | 1 59 | 35 | 10 46 | 65 | 8 49 |
| 6 | 2 23 | 36 | 10 54 | 66 | 8 33 |
| 7 | 2 46 | 37 | 11 1 | 67 | 8 17 |
| 8 | 3 9 | 38 | 11 8 | 68 | 8 0 |
| 9 | 3 32 | 39 | 11 13 | 69 | 7 42 |
| 10 | 3 55 | 40 | 11 18 | 70 | 7 24 |
| 11 | 4 17 | 41 | 11 22 | 71 | 7 5 |
| 12 | 4 39 | 42 | 11 25 | 72 | 6 46 |
| 13 | 5 1 | 43 | 11 27 | 73 | 6 26 |
| 14 | 5 22 | 44 | 11 28 | 74 | 6 6 |
| 15 | 5 43 | 45 | 11 29 | 75 | 5 45 |
| 16 | 6 4 | 46 | 11 28 | 76 | 5 24 |
| 17 | 6 24 | 47 | 11 27 | 77 | 5 3 |
| 18 | 6 44 | 48 | 11 25 | 78 | 4 41 |
| 19 | 7 3 | 49 | 11 22 | 79 | 4 19 |
| 20 | 7 22 | 50 | 11 19 | 80 | 3 56 |
| 21 | 7 40 | 51 | 11 14 | 81 | 3 33 |
| 22 | 7 57 | 52 | 11 9 | 82 | 3 10 |
| 23 | 8 14 | 53 | 11 3 | 83 | 2 47 |
| 24 | 8 31 | 54 | 10 56 | 84 | 2 24 |
| 25 | 8 46 | 55 | 10 48 | 85 | 2 0 |
| 26 | 9 2 | 56 | 10 39 | 86 | 1 36 |
| 27 | 9 16 | 57 | 10 30 | 87 | 1 12 |
| 28 | 9 30 | 58 | 10 20 | 88 | 0 48 |
| 29 | 9 43 | 59 | 10 9 | 89 | 0 24 |

## TABLE XXXVI.

**AUGMENTATION OF THE MOON'S SEMIDIAMETER**

| App. Alt. | Semidiameter | | | | | |
|---|---|---|---|---|---|---|
| | 14′ | 15′ | | 16′ | | 17′ |
| | 30″ | 0″ | 30″ | 0″ | 30″ | 0″ |
| 0° | 0″·1 | 0″·1 | 0″·1 | 0″·1 | 0″·1 | 0″·1 |
| 2 | 0·6 | 0·6 | 0·7 | 0·7 | 0·8 | 0·8 |
| 4 | 1·0 | 1·1 | 1·2 | 1·3 | 1·4 | 1·5 |
| 6 | 1·5 | 1·6 | 1·7 | 1·9 | 2·0 | 2·1 |
| 8 | 2·0 | 2·1 | 2·2 | 2·4 | 2·5 | 2·7 |
| 10 | 2·4 | 2·7 | 2·8 | 3·0 | 3·2 | 3·3 |
| 12 | 2·9 | 3·2 | 3·3 | 3·5 | 3·7 | 4·0 |
| 14 | 3·4 | 3·6 | 3·8 | 4·1 | 4·4 | 4·6 |
| 16 | 3·9 | 4·1 | 4·4 | 4·7 | 5·0 | 5·2 |
| 18 | 4·3 | 4·6 | 4·9 | 5·2 | 5·5 | 5·9 |
| 21 | 4·9 | 5·3 | 5·7 | 6·0 | 6·4 | 6·7 |
| 24 | 5·6 | 6·0 | 6·4 | 6·8 | 7·2 | 7·7 |
| 27 | 6·2 | 6·7 | 7·2 | 7·6 | 8·1 | 8·6 |
| 30 | 6·9 | 7·4 | 7·9 | 8·4 | 8·9 | 9·4 |
| 33 | 7·5 | 8·0 | 8·6 | 9·1 | 9·6 | 10·3 |
| 36 | 8·0 | 8·6 | 9·2 | 9·8 | 10·4 | 11·1 |
| 39 | 8·6 | 9·2 | 9·9 | 10·5 | 11·1 | 11·8 |
| 42 | 9·1 | 9·8 | 10·4 | 11·2 | 11·8 | 12·6 |
| 45 | 9·7 | 10·3 | 11·0 | 11·8 | 12·5 | 13·3 |
| 48 | 10·2 | 10·9 | 11·6 | 12·4 | 13·1 | 14·0 |
| 51 | 10·6 | 11·3 | 12·1 | 12·9 | 13·7 | 14·6 |
| 54 | 11·1 | 11·8 | 12·6 | 13·5 | 14·3 | 15·2 |
| 57 | 11·5 | 12·3 | 13·1 | 14·0 | 14·8 | 15·7 |
| 63 | 12·2 | 13·0 | 13·9 | 14·8 | 15·7 | 16·7 |
| 70 | 12·7 | 13·7 | 14·7 | 15·7 | 16·6 | 17·6 |
| 78 | 13·3 | 14·3 | 15·3 | 16·3 | 17·3 | 18·4 |
| 90 | 13·5 | 14·6 | 15·6 | 16·7 | 17·6 | 18·6 |

# INDEX.

[*To face last p. of Index.*

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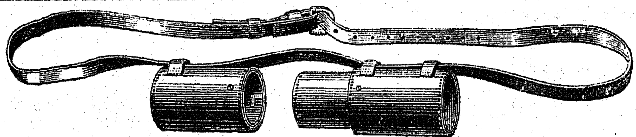


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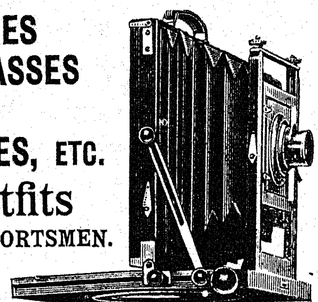

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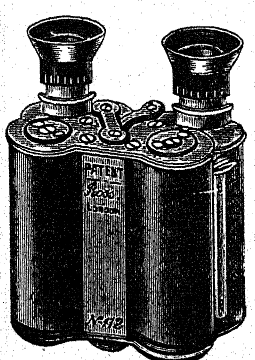

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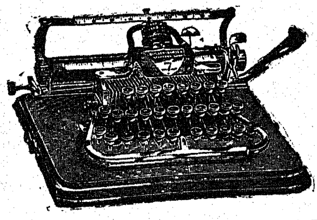

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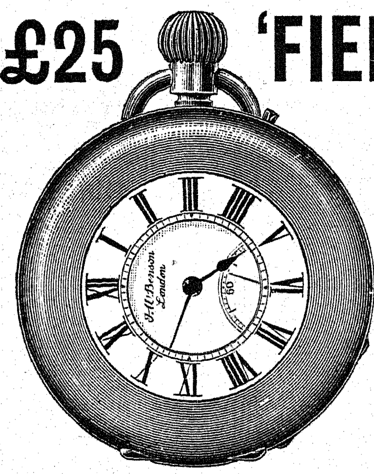

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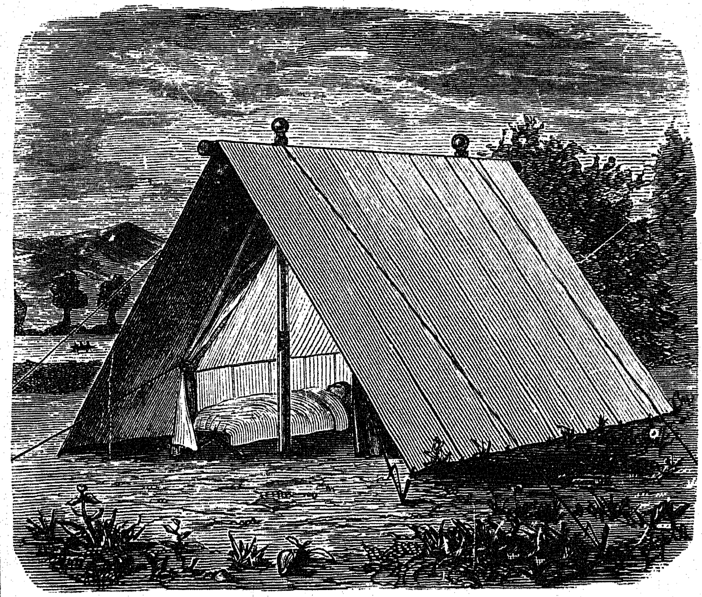

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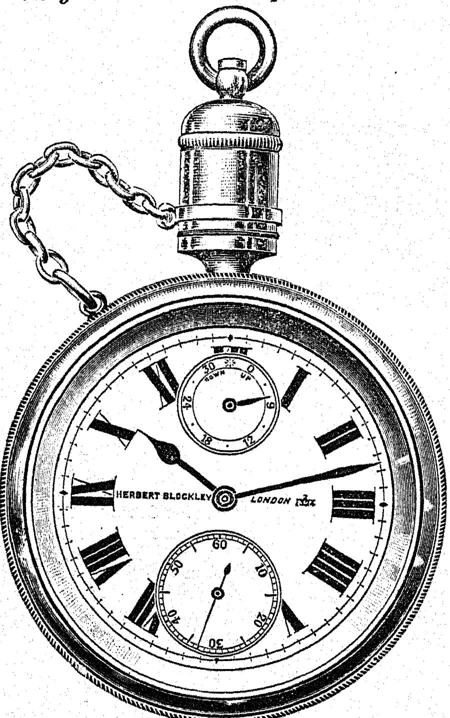


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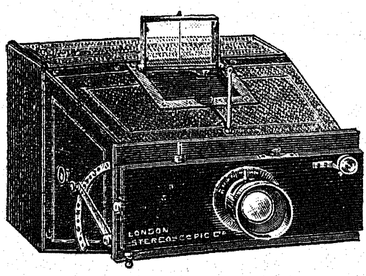


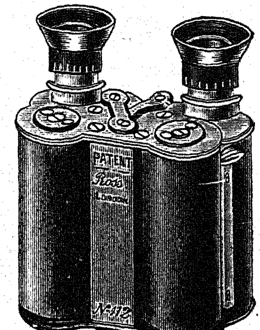


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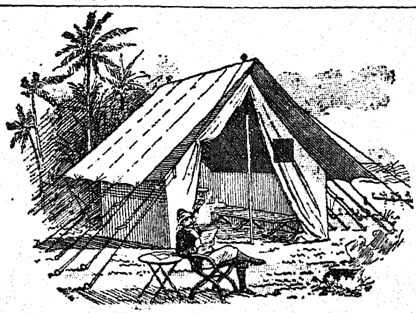

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